FINAL REPORT

ECONOMICS OF ON-SITE CONSERVATION PRACTICES IN TERMS OF OFF-SITE BENEFITS

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Special Study For:

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November 30, 1987

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INTRODUCTION

This report presents the findings of a study to assess the off-site, economic benefits of conservation practices for reducing wind erosion in New Mexico. The study seeks to determine where the greatest returns from conservation programs are likely and the magnitude of anticipated returns. The study is a follow-up to an earlier study which determined the off-site costs of wind erosion in New Mexico [2].

The findings of this study include: (1) a wind erosion damage function which relates on-site erosion rates with off-site costs, (2) use of the damage function to determine the distribution of off-site costs by county, (3) projections of off-site costs over time by MLRA and county, and (4) measurements of off-site benefits of conservation practices.

A strong case exists for making off-site costs of wind erosion the principle focus of erosion control policy in New Mexico. First, the off-site costs of wind erosion dwarf the on-site costs. Annual on-site costs of wind erosion have been estimated to be $10 million [1], while off-site costs are estimated to equal nearly $466 million annually [2]. Second, farmers and ranchers have little incentive to control off-site costs. While they have an economic incentive to control on-site costs whenever control costs are less than the damage costs, but they have no comparable incentive to control off-site costs which they do not bear them.

Moreover, it has been argued that targeting will increase the efficiency of soil conservation programs. That is, soil conservation expenditures should be targeted to those areas having the greatest problems in order to produce the greatest net returns. In fact, a national program to target conservation efforts was initiated by U.S.D.A. in 1981 [4].

The results of this study provide information necessary for targeting soil conservation efforts to sources of off-site costs in New Mexico. It provides estimates of potential returns from targeting specific geographic areas and from using specific conservation practices.

The wind erosion damage function developed in the next section specifies the relationship between off-site costs and on-site erosion rates. This damage function provides the basis in for identifying geographic locations (i.e., counties) with the greatest off-site costs of wind erosion and for projecting off-site costs as a function of changing population and erosion rates. In particular, it provides estimates of returns from erosion rate reductions in specific geographical areas of the state. Finally, the returns from the expansion of current conservation programs are estimated for different land classifications by MLRA.

DAMAGE FUNCTION

A wind erosion damage function relating off-site costs with on-site erosion rates was developed using a multiple regression analysis and the data base collected in the previous study of off-site costs of wind erosion in New Mexico [2]. After exhaustive testing of alternative specifications of the damage function, the following equation was found to be the best:

$$Z = e^{3.8379} \underset{(2.47)}{X^{0.3092}} \; \underset{(4.24)}{Y^{0.7044}} \tag{1}$$

where: Z = off-site costs in millions of dollars,
X = wind erosion in tons per acre, and
Y = income in billions of dollars.

The equation explains 91 percent of the variation in off-site costs and the t-values, shown in parentheses, are significant at the 0.1 and 0.05 levels, respectively.

The income variable is a composite of the population and the per capita income of that population. That is, off-site costs of wind erosion depend upon both the number of persons impacted by blowing sand and dust and the value of the property affected per person, for which per capita income provides a proxy measure.

A three dimensional plot of Equation (1) is shown in Figure 1. Off-site costs increase at a decreasing rate with both the rate of wind erosion and income. In fact, from Equation (1) it can be seen that a 1 percent increase in the wind erosion rate will increase off-site costs by 0.3 percent and a 1 percent increase in income will increase off-site costs by 0.7 percent.

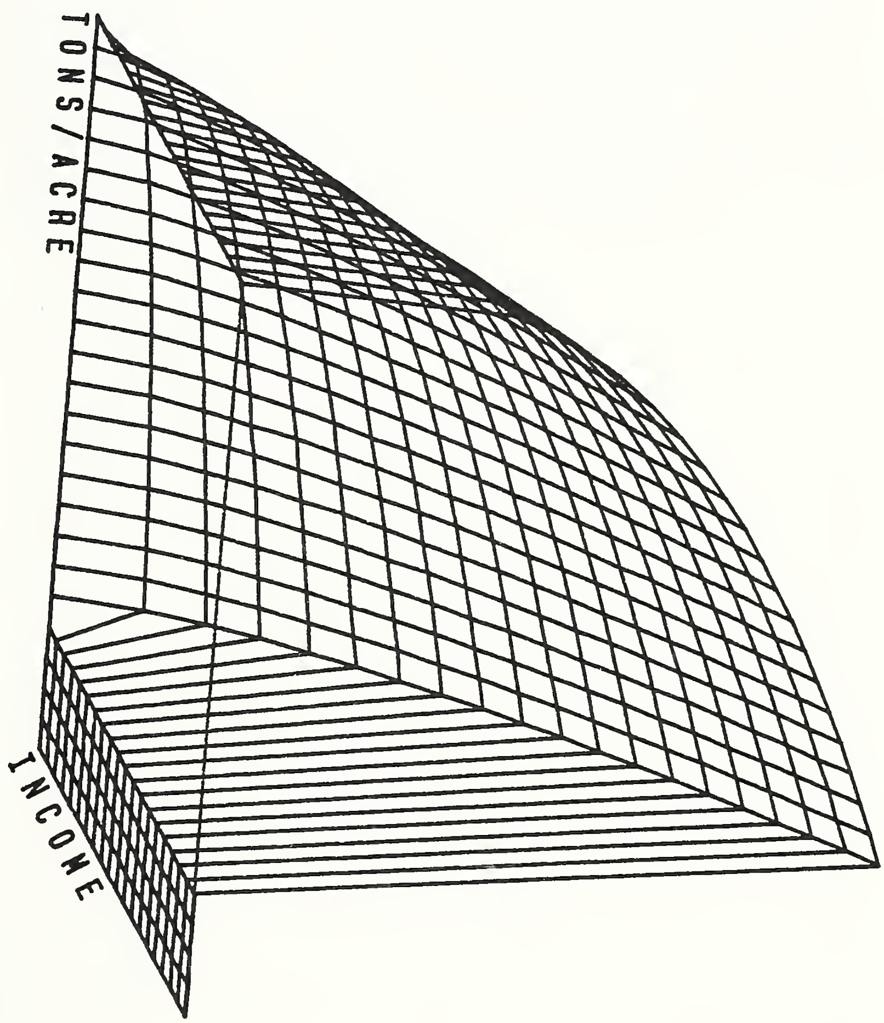


FIGURE 1. OFF-SITE DAMAGE FUNCTION

The main shortcoming of the damage function is that it treats all wind erosion and all property at risk alike. It is likely, however, that erosion nearer population centers is responsible for greater off-site costs than erosion occuring further away and that property on the periphery of cities incurs greater costs than property more protected within the city. But such distinctions require a transport model for the wind erosion and, while many models exist for localized soil movements, none has been found to predict the soil movements necessary for this study. Further research is needed to fine tune the damage function to account for such locational factors.

DISTRIBUTION OF OFF-SITE COSTS

It is anticipated that returns from conservation programs can be maximized by targeting those areas with the greatest damages. Therefore, the damage function is used to determine the distribution of estimated off-site costs by MLRA among the counties comprising those areas.

Table 1 summarizes the input and output values of the damage function. Population and per capita income values are from the Census of Population; the average erosion rates are derived from the National Resources Inventory (NRI) computer tapes for New Mexico [3].

The estimated off-site costs by MLRA were derived in the previous study [2]. The damage function is used to predict the share of the MLRA's off-site costs to be distributed to each county within the MLRA. The distribution of off-site costs by county are summarized in Figures 2 and 3.

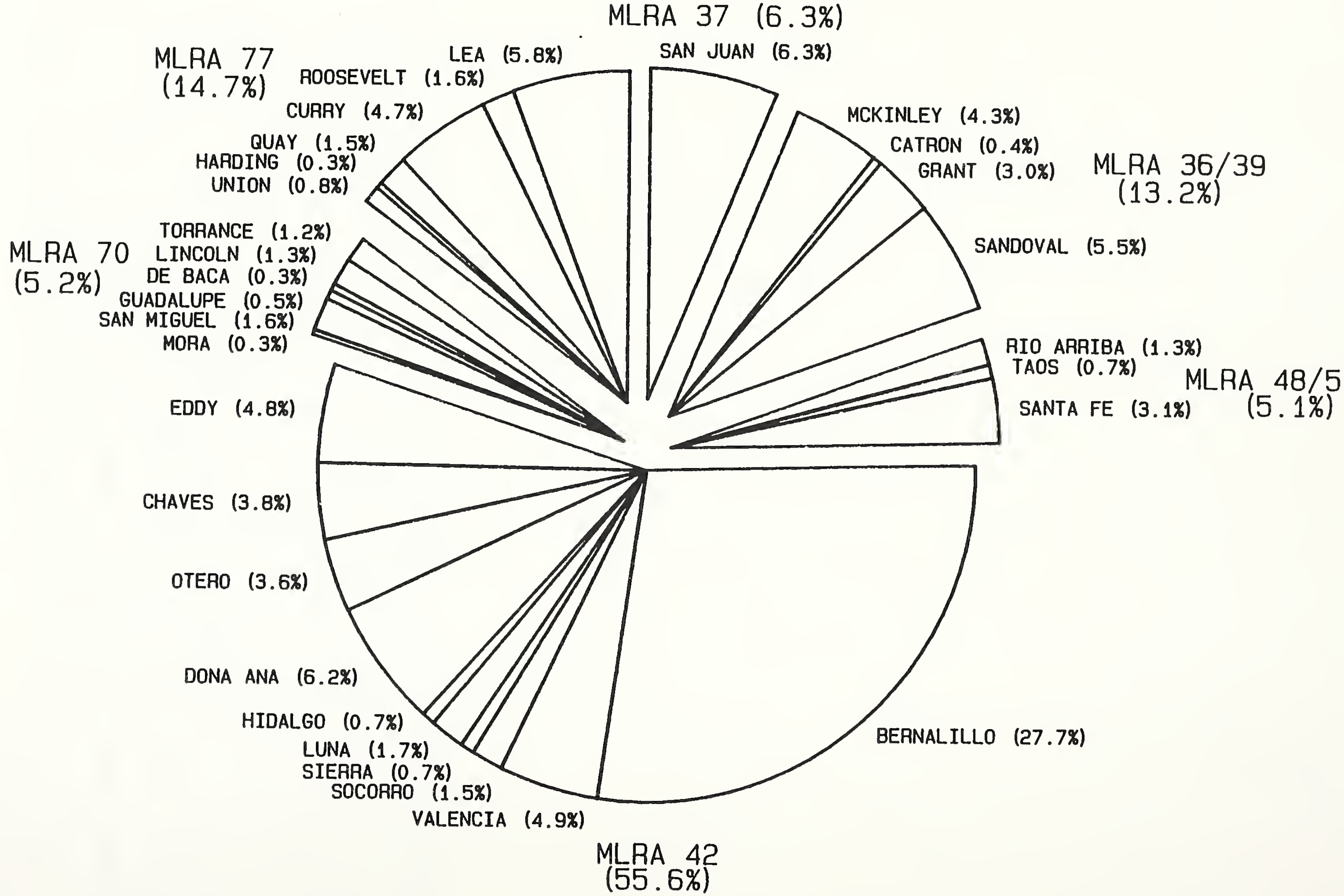
It can be seen from Figures 2 that over 55 percent of the off-site costs in the state are incurred in MLRA 42 and, within MLRA 42, Bernalillo County accounts for nearly 50 percent of the damages. In fact, the $128 million of off-site damages in Bernalillo County represents nearly 28 percent of total off-site damages for the state.

Figure 2 also indicates that five counties account for over 50 percent of the state's off-site costs from wind erosion. Bernalillo and Dona Ana counties in MLRA 42, San Juan County in

TABLE 1. POPULATION, INCOME, EROSION RATES AND ESTIMATED OFF-SITE COSTS BY MLRA AND COUNTY, 1984

MLRA	COUNTY	POPULATION	PER CAPITA INCOME	TOTAL INCOME ($ MILLION)	AVERAGE EROSION RATE	ESTIMATED OFF-SITE COSTS ($ MILLION)
37	SAN JUAN	81,433	5,814	473.45	3.0	29.28
	TOTAL	81,433	5,814	473.45	3.0	29.28
36/39	MCKINLEY	56,449	4,196	236.86	0.8	20.03
	CATRON	2,720	4,695	12.77	0.4	2.07
	GRANT	26,204	5,703	149.44	0.7	13.89
	SANDOVAL	34,799	5,117	178.07	3.4	25.62
	TOTAL	120,172	4,803	577.14	1.7	61.61
48/51	RIO ARRIBA	29,282	3,937	115.28	0.5	5.97
	TAOS	19,456	4,613	89.75	0.1	3.04
	COLFAX	13,667	5,515	75.37	0.0	0.00
	SANTA FE	75,360	6,855	516.59	0.3	14.67
	LOS ALAMOS	17,599	10,442	183.77	0.0	0.00
	TOTAL	155,364	6,313	980.77	0.5	23.69
42	BERNALILLO	419,700	7,136	2,994.98	13.9	128.84
	VALENCIA	61,115	5,850	357.52	6.4	22.68
	SOCORRO	12,556	4,469	56.11	10.7	7.21
	SIERRA	8,454	4,637	39.20	1.8	3.23
	LUNA	15,585	4,790	74.65	7.4	7.87
	HIDALGO	6,049	5,242	31.71	2.6	3.12
	DONA ANA	96,340	5,284	509.06	6.2	28.81
	OTERO	44,665	5,379	240.25	5.7	16.54
	CHAVES	51,103	5,828	297.83	4.2	17.51
	EDDY	47,855	6,057	289.86	10.0	22.46
	TOTAL	763,422	6,407	4,891.18	6.7	258.27
70	MORA	4,205	3,404	14.31	0.2	1.24
	SAN MIGUEL	22,751	3,904	88.82	1.0	7.36
	GUADALUPE	4,496	3,850	17.31	0.8	2.17
	DE BACA	2,454	5,187	12.73	0.6	1.60
	LINCOLN	10,997	6,388	70.25	1.0	6.24
	TORRANCE	7,491	4,691	35.14	3.6	5.69
	TOTAL	52,394	4,553	238.56	1.3	24.29
77	UNION	4,725	5,957	28.15	5.8	3.90
	HARDING	1,090	5,267	5.74	7.0	1.35
	QUAY	10,577	5,561	58.82	7.7	7.16
	CURRY	42,019	5,962	250.52	10.7	22.01
	ROOSEVELT	15,695	5,180	81.30	4.2	7.46
	LEA	55,993	6,921	387.53	7.5	26.81
	TOTAL	130,099	6,242	812.05	7.1	68.70
TOTAL		1,302,884	34,131	7,973.15		465.84

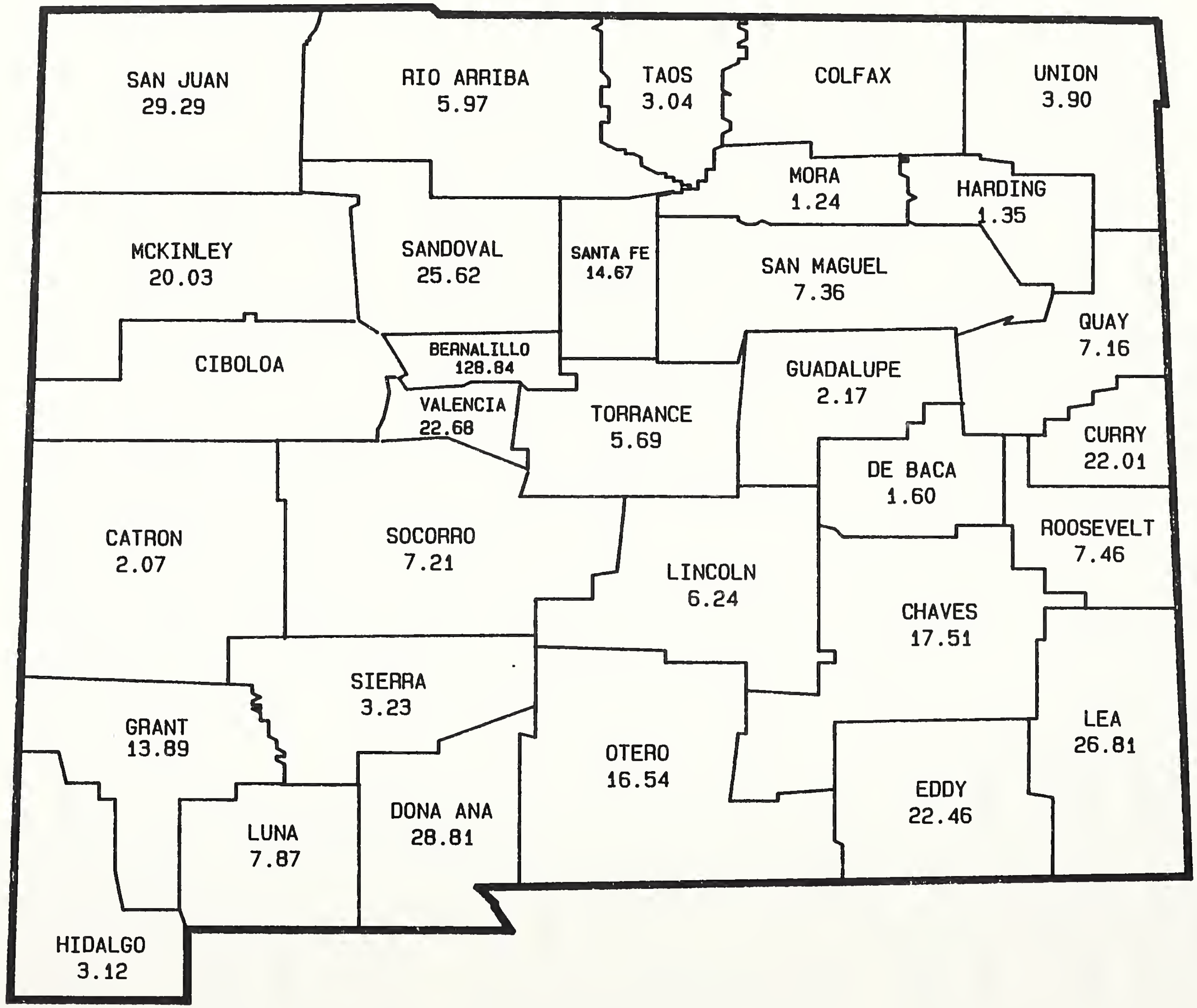
FIGURE 2. DISTRIBUTION OF OFF-SITE COSTS BY MLRA AND COUNTY



MLRA 37, Lea County in MLRA 77, and Sandoval County in MLRA 36/39 together account for 51.5 percent of the state's off-site wind erosion costs.

Figure 3 shows a map of the counties in New Mexico and the estimated off-site costs of wind erosion in each county. Nine counties have annual off-site costs in excess of $20 million: Bernalillo, Valencia, McKinley, Sandoval, San Juan, Dona Ana, Eddy, Lea and Curry counties. At the other end of the spectrum, twelve counties have estimated annual off-site costs of less than $5 million: Union, Sierra, Hidalgo, Taos, Guadalupe, Catron, DeBaca, Harding, Mora, Colfax, Los Alamos and Ciboloa counties.

FIGURE 3. MAP OF OFF–SITE COSTS BY COUNTY, 1984
($ MILLION)



PROJECTION OF OFF-SITE COSTS

The damage function can also be used to project off-site costs as either a function of changing population or erosion rates.

EFFECTS OF CHANGING POPULATION

Population projections by MLRA and county are shown in Table 2. Assuming constant erosion rates and per capita incomes, these projections are used in the damage function to predict off-site costs for the period from 1984 to 2005, as shown in Table 3. Figure 4 summarizes these projections by MLRA and Figures 5 through 9 summarize them by county.

For example, the population of MLRA 42 is predicted to increase from 832,000 in 1985 to 1,129,000 in 2005, or an increase of 297,000 people (36 percent). If erosion rates and per capita incomes within MLRA remain unchanged, then this population growth will result in a growth of annual off-site costs from $258.27 million in 1985 to $320.16 million in 2005, or an increase of nearly $63 million (24 percent), as shown in Table 3 and Figure 4.

Moreover, the population of Bernalillo County is expected to grow from 470,200 in 1985 to 621,200 in 2005, or by 151,000 persons (32 percent). Again assuming unchanged erosion rates and per capita incomes, this population growth can be expected to cause annual off-site costs to increase from approximately $128.84 million in 1985 to $156.77 in 2005, an increase of $28 million (22 percent), as shown in Table 3 and Figure 7.

TABLE 2. POPULATION PROJECTIONS BY MLRA AND COUNTY

MLRA	COUNTY	1985	1990	1995	2000	2005
37	SAN JUAN	91,700	99,500	112,800	128,000	142,900
	TOTAL	91,700	99,500	112,800	128,000	142,900
36/39	MCKINLEY	62,800	70,900	79,400	89,200	99,200
	CATRON	2,800	3,000	3,100	3,300	3,500
	GRANT	27,400	29,500	30,100	32,200	34,200
	SANDOVAL	44,200	51,900	60,400	68,900	77,300
	TOTAL	137,200	155,300	173,000	193,600	214,200
48/51	RIO ARRIBA	32,900	35,300	38,800	42,300	45,800
	TAOS	22,300	23,600	25,800	28,000	30,200
	SANTA FE	84,700	90,300	96,600	102,600	107,900
	TOTAL	139,900	149,200	161,200	172,900	183,900
42	BERNALILLO	470,200	510,200	551,300	588,500	621,200
	VALENCIA	35,300	39,400	44,100	48,600	52,900
	SOCORRO	13,900	15,100	16,700	18,100	19,500
	SIERRA	9,500	10,200	10,500	10,500	10,300
	LUNA	17,800	19,800	21,300	22,500	23,700
	HIDALGO	6,200	6,700	7,100	7,600	8,200
	DONA ANA	121,100	144,000	162,200	179,900	196,000
	OTERO	49,500	54,300	58,500	62,500	66,800
	CHAVES	56,500	57,500	60,300	63,200	66,200
	EDDY	52,900	55,000	58,100	61,500	65,100
	TOTAL	832,900	912,200	990,100	1,062,900	1,129,900
70	MORA	4,600	4,900	5,100	5,400	5,500
	SAN MIGUEL	25,000	27,000	29,200	31,300	33,400
	GUADALUPE	4,500	4,600	4,700	4,800	4,900
	DE BACA	2,400	2,400	2,300	2,300	2,200
	LINCOLN	14,200	15,600	16,800	18,000	19,000
	TORRANCE	8,600	940	10,400	11,400	12,300
	TOTAL	59,300	55,440	68,500	73,200	77,300
77	UNION	5,000	5,000	5,000	4,900	4,900
	HARDING	1,000	1,000	900	900	900
	QUAY	11,700	11,800	11,800	11,800	11,900
	CURRY	41,600	41,900	41,700	41,700	42,000
	ROOSEVELT	16,400	17,200	17,800	18,200	18,600
	LEA	65,900	66,300	71,200	77,100	83,900
	TOTAL	141,600	143,200	148,400	154,600	162,200
TOTAL		1,402,600	1,514,840	1,654,000	1,785,200	1,910,400

SOURCE: BUREAU OF BUSINESS AND ECONOMIC RESEARCH, UNIVERSITY OF NEW MEXICO

TABLE 3. PROJECTIONS OF OFF-SITE WIND EROSION COSTS BASED UPON POPULATION PROJECTIONS BY MLRA AND COUNTY

MLRA	COUNTY	ESTIMATED OFF-SITE COSTS 1984	1990	1995	2000	2005
37	SAN JUAN	29.28	31.01	33.88	37.03	40.02
	TOTAL	29.28	31.01	33.88	37.03	40.02
36/39	MCKINLEY	20.03	21.81	23.63	25.64	27.64
	CATRON	2.07	2.17	2.22	2.32	2.42
	GRANT	13.89	14.63	14.84	15.57	16.24
	SANDOVAL	25.62	28.69	31.93	35.03	37.99
	TOTAL	61.61	67.23	72.54	78.52	84.32
48/51	RIO ARRIBA	5.97	6.28	6.71	7.13	7.54
	TAOS	3.04	3.17	3.37	3.57	3.77
	SANTA FE	14.67	15.35	16.10	16.79	17.40
	TOTAL	23.69	24.79	26.18	27.50	28.72
42	BERNALILLO	128.84	136.47	144.12	150.91	156.77
	VALENCIA	22.68	24.51	26.53	28.41	30.16
	SOCORRO	7.21	7.65	8.21	8.69	9.16
	SIERRA	3.23	3.40	3.47	3.47	3.42
	LUNA	7.87	8.48	8.93	9.28	9.63
	HIDALGO	3.12	3.29	3.43	3.60	3.79
	DONA ANA	28.81	32.55	35.39	38.07	40.44
	OTERO	16.54	17.65	18.60	19.49	20.43
	CHAVES	17.51	17.73	18.33	18.95	19.58
	EDDY	22.46	23.09	23.99	24.98	26.00
	TOTAL	258.27	275.36	291.72	306.67	320.16
70	MORA	1.24	1.29	1.33	1.38	1.40
	SAN MIGUEL	7.36	7.77	8.21	8.62	9.02
	GUADALUPE	2.17	2.20	2.24	2.27	2.30
	DE BACA	1.60	1.60	1.55	1.55	1.50
	LINCOLN	6.24	6.66	7.02	7.37	7.66
	TORRANCE	5.69	6.06	6.50	6.94	7.32
	TOTAL	24.29	23.17	26.89	28.17	29.28
77	UNION	3.90	3.90	3.90	3.85	3.85
	HARDING	1.35	1.35	1.25	1.25	1.25
	QUAY	7.16	7.21	7.21	7.21	7.25
	CURRY	22.01	22.12	22.05	22.05	22.16
	ROOSEVELT	7.46	7.71	7.90	8.03	8.15
	LEA	26.81	26.93	28.31	29.95	31.78
	TOTAL	68.70	69.25	71.01	73.08	75.60
TOTAL		465.84	490.80	522.21	550.99	578.10

FIGURE 4. PROJECTED OFF-SITE COSTS BY MLRA

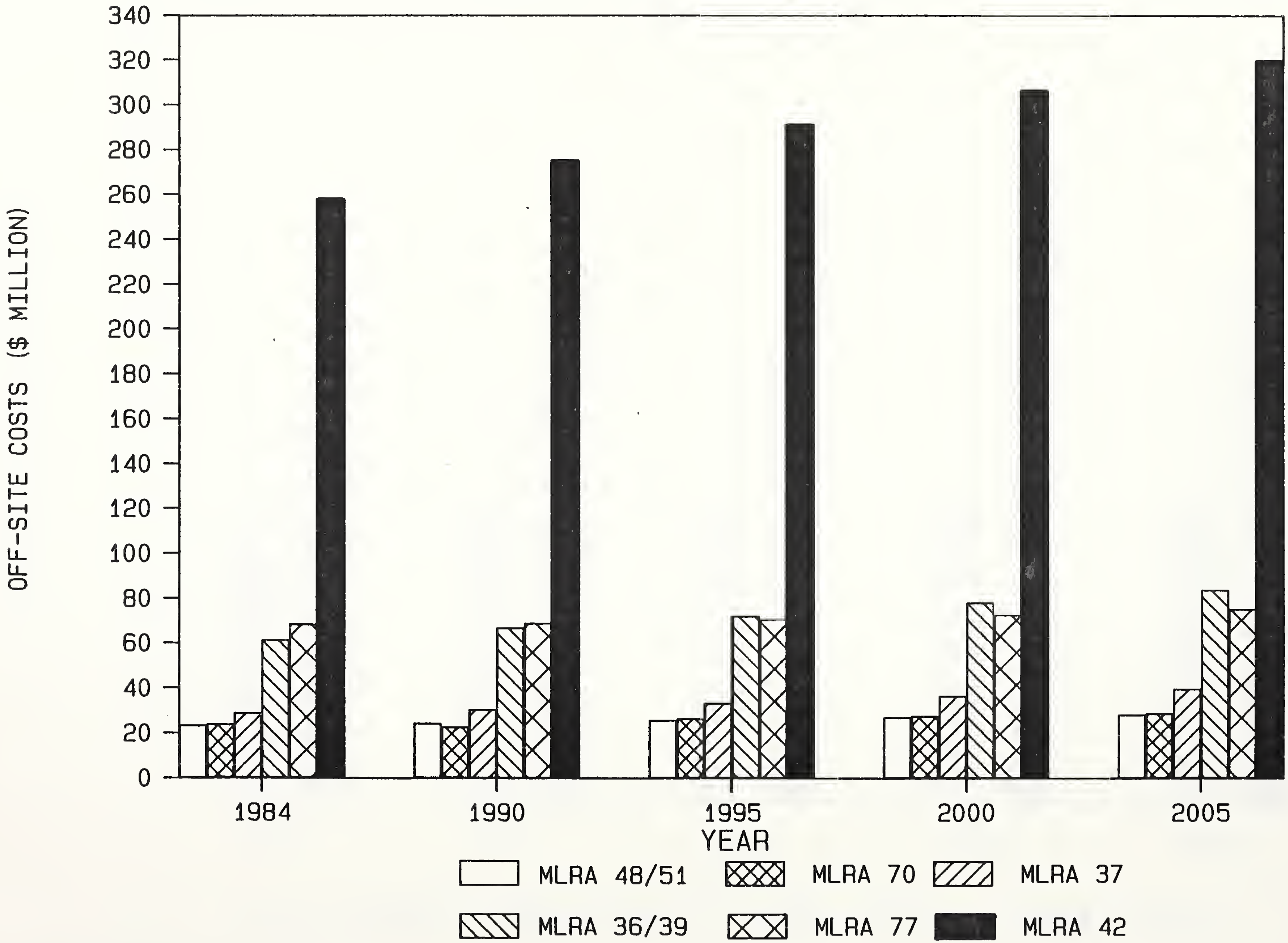


FIGURE 5. PROJECTED OFF-SITE COSTS BY COUNTY
MLRA 36/39

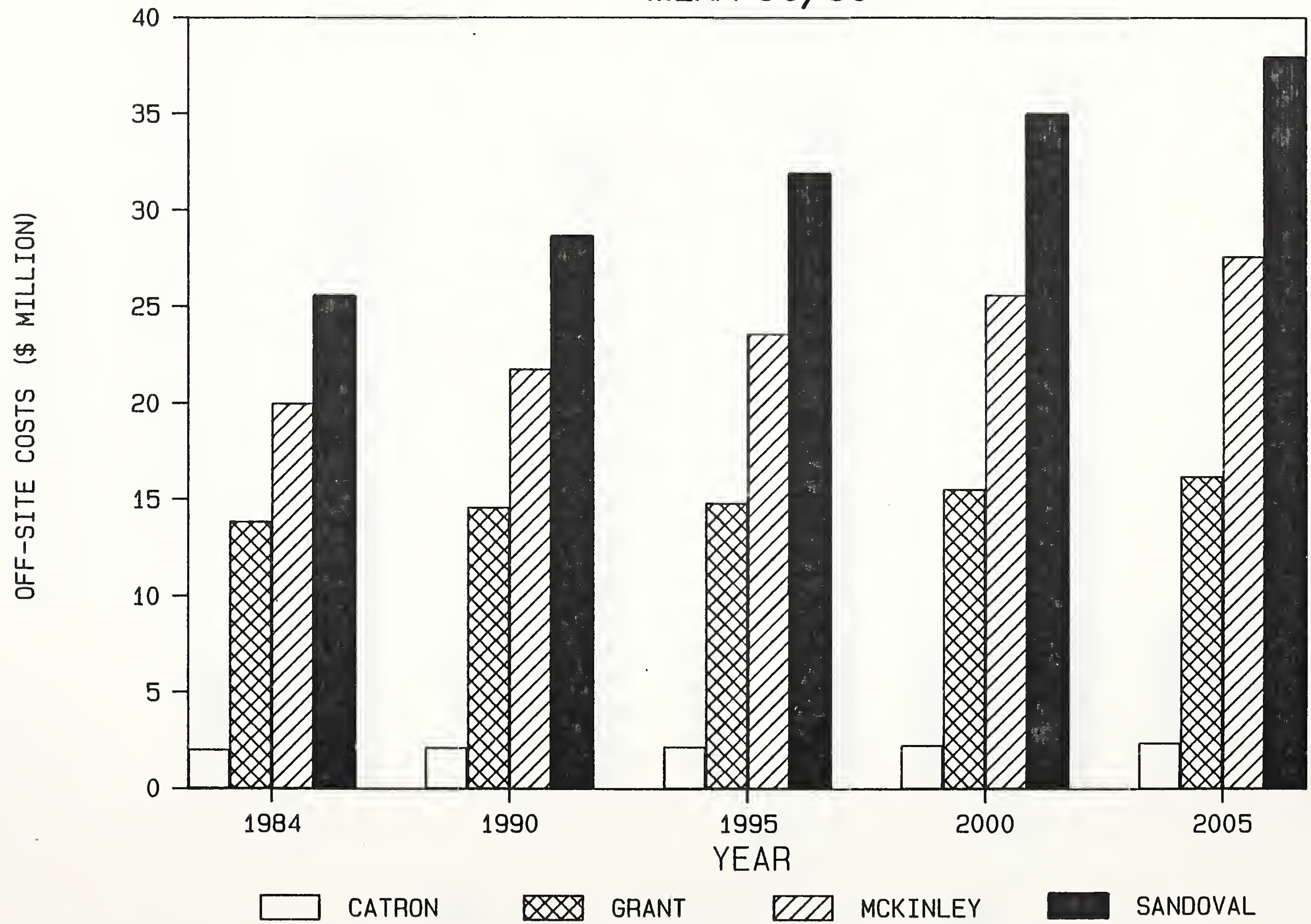


FIGURE 6. PROJECTED OFF-SITE COSTS BY COUNTY
MLRA 48/51

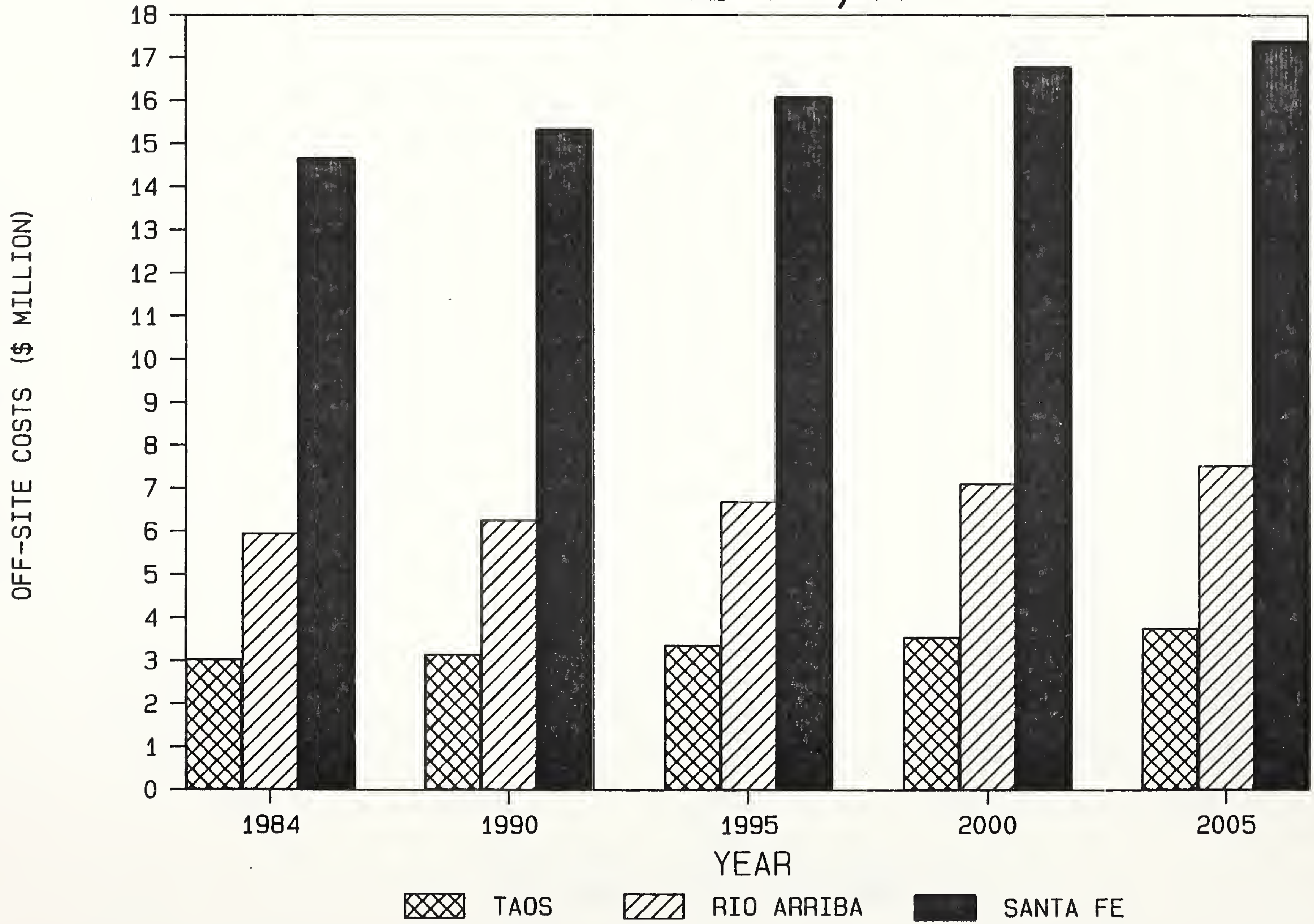


FIGURE 7. PROJECTED OFF-SITE COSTS BY COUNTY
MLRA 42

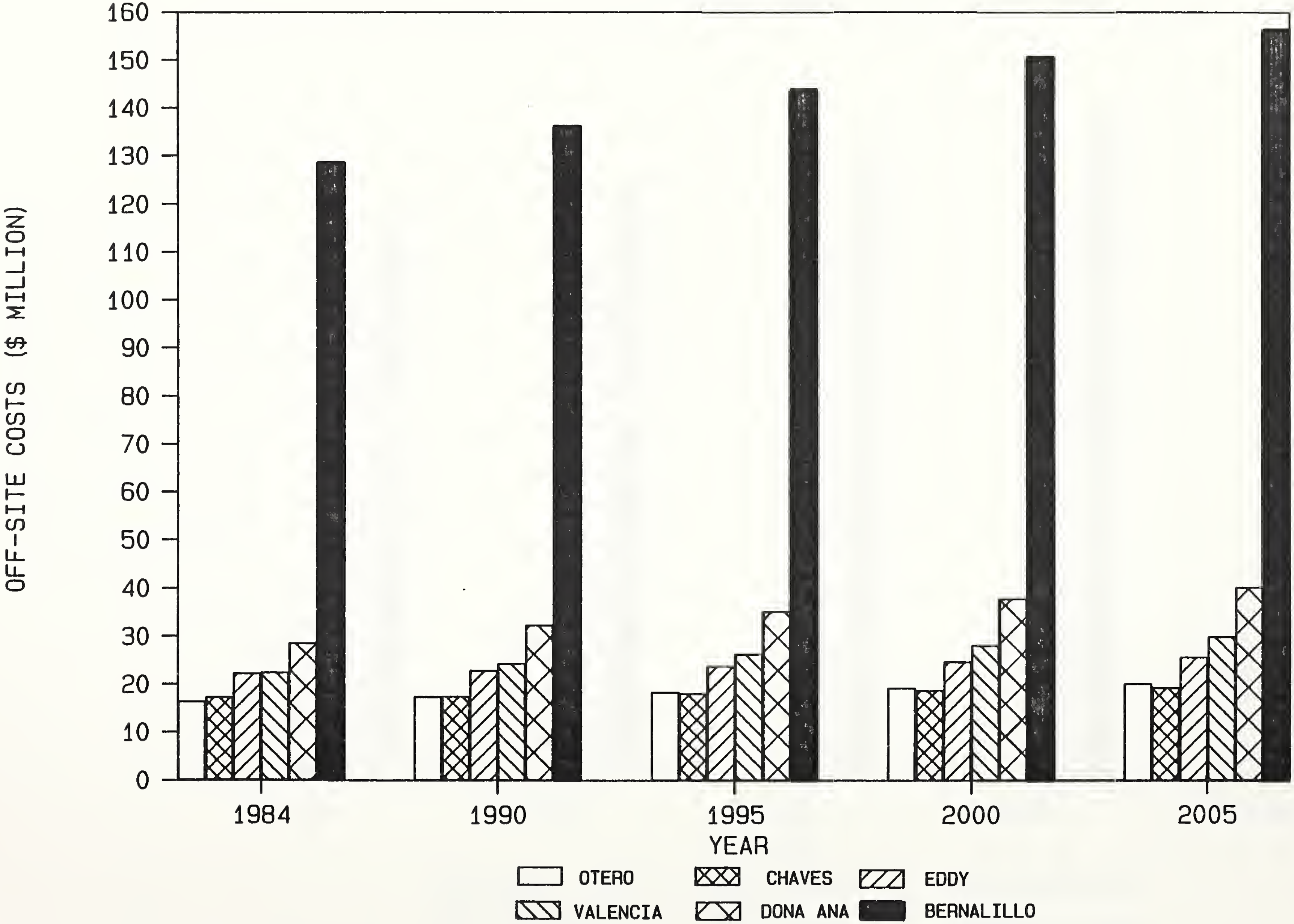
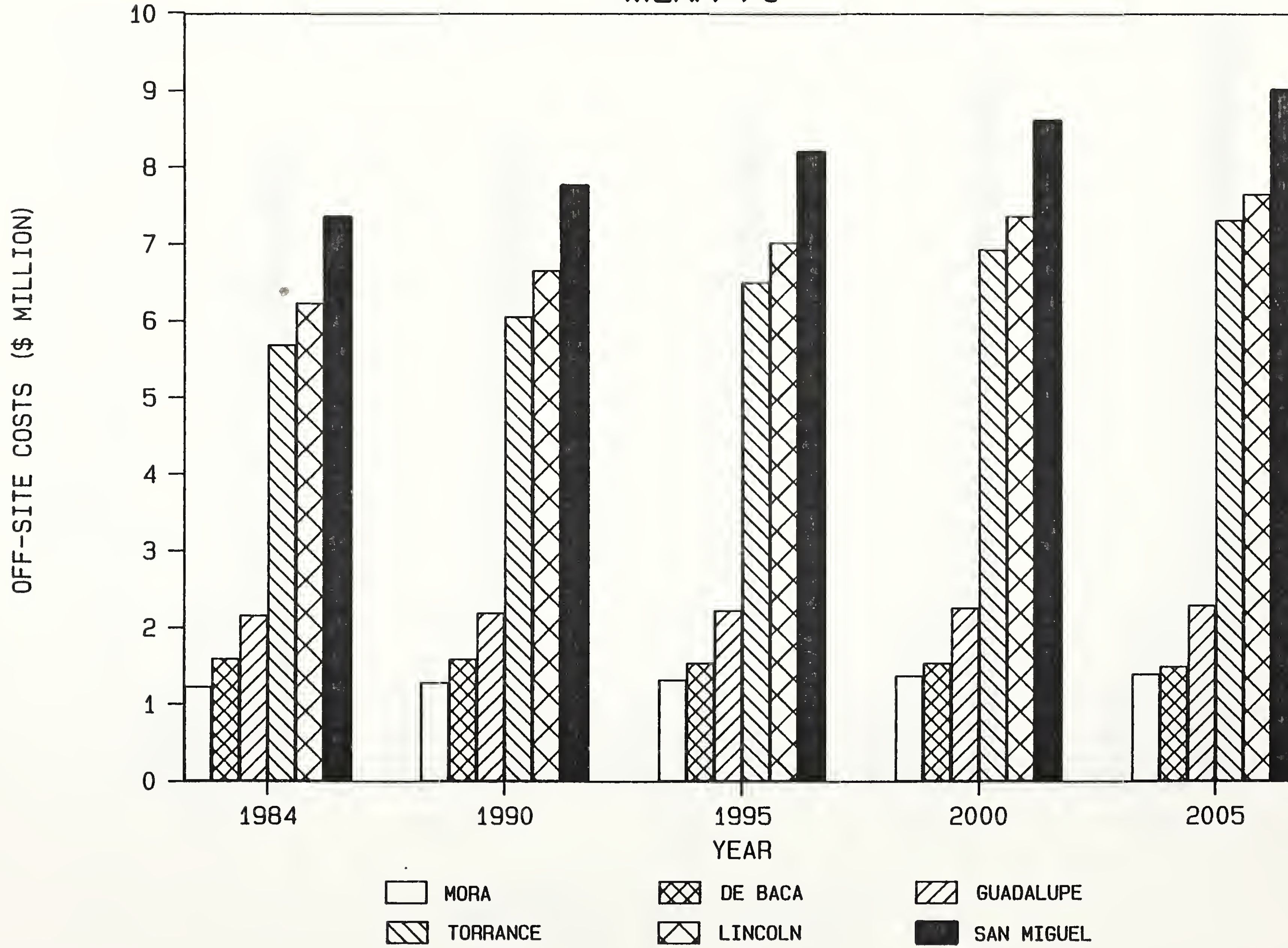


FIGURE 8. PROJECTED OFF-SITE COSTS BY COUNTY
MLRA 70



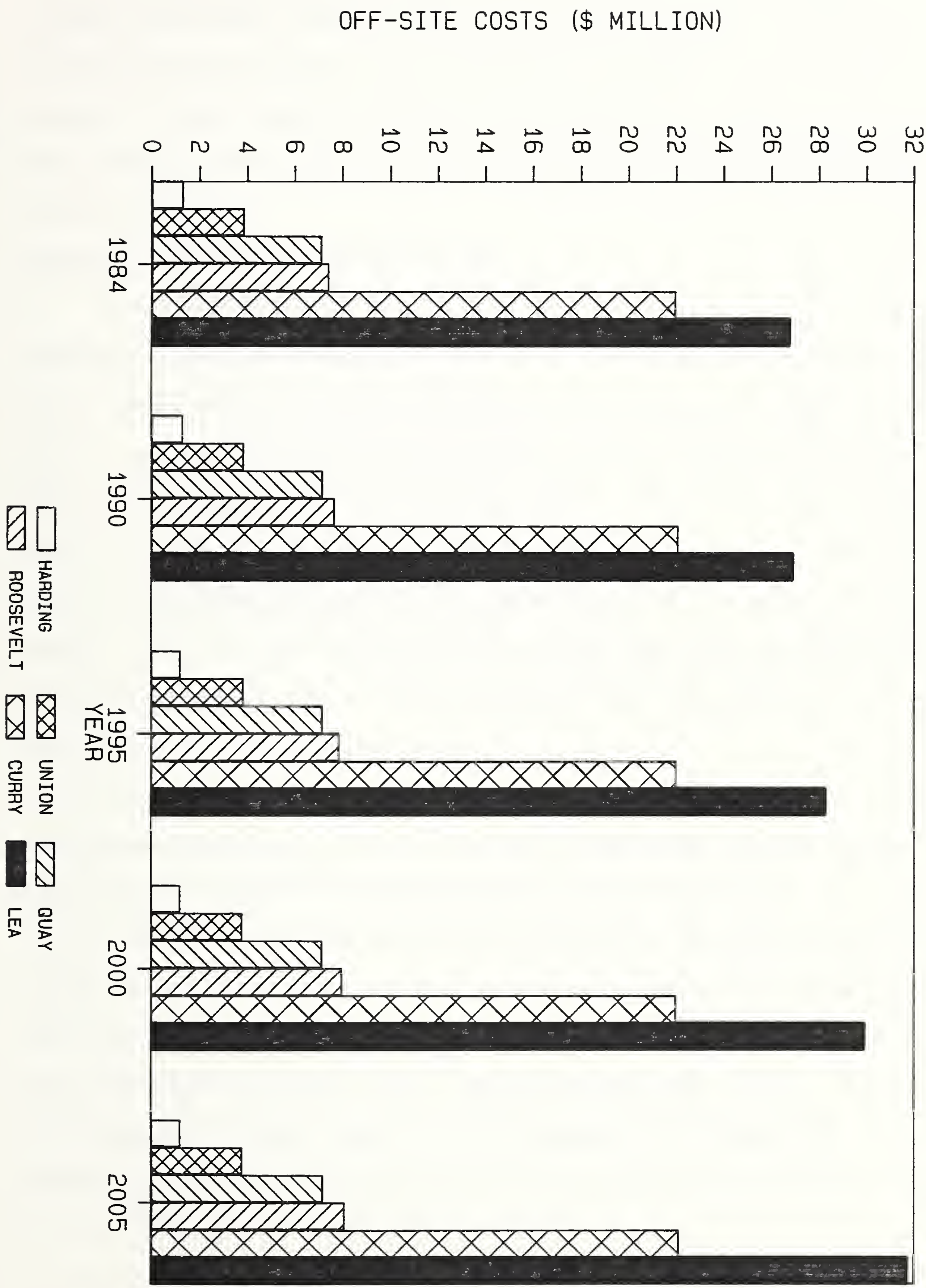


FIGURE 9. PROJECTED OFF-SITE COSTS BY COUNTY
MLRA 77

The data contained in Table 3 and Figures 4 through 9 clearly show that MLRA 42 has the greatest level of off-site costs from wind erosion and the greatest amount of predicted growth in these costs, and that within MLRA 42, Bernalillo County has the both the highest level and greatest predicted growth of off-site costs.

EFFECTS OF CHANGING EROSION RATES

Alternatively, if population and per capita incomes are held constant, then the damage function can be used to predict off-site costs resulting from varying erosion rates. Figures 10, 12, 14, 16, 18 and 20 show the predicted, total, off-site costs by MLRA for different erosion rates, when the value of the property at risk is held constant. Figures 11, 13, 15, 17, 19 and 21 show the corresponding marginal, off-site costs for different erosion rates. That is, the marginal cost relations show the addition (or reduction) to total off-site costs from an addition (or reduction) to the erosion rate.

The fact that the slopes of the total off-site cost functions decline as the erosion rate increases implies that costs do not increase proportionately with erosion. Alternatively, this implies that a reduction in wind erosion will yield a less than proportional decrease in off-site costs and that the greatest reductions in off-site costs will be associated with reductions in low rather than high erosion rates. This relationship is also shown by the marginal off-site cost functions.

FIGURE 10. TOTAL OFF—SITE COSTS OF WIND EROSION
MLRA 37

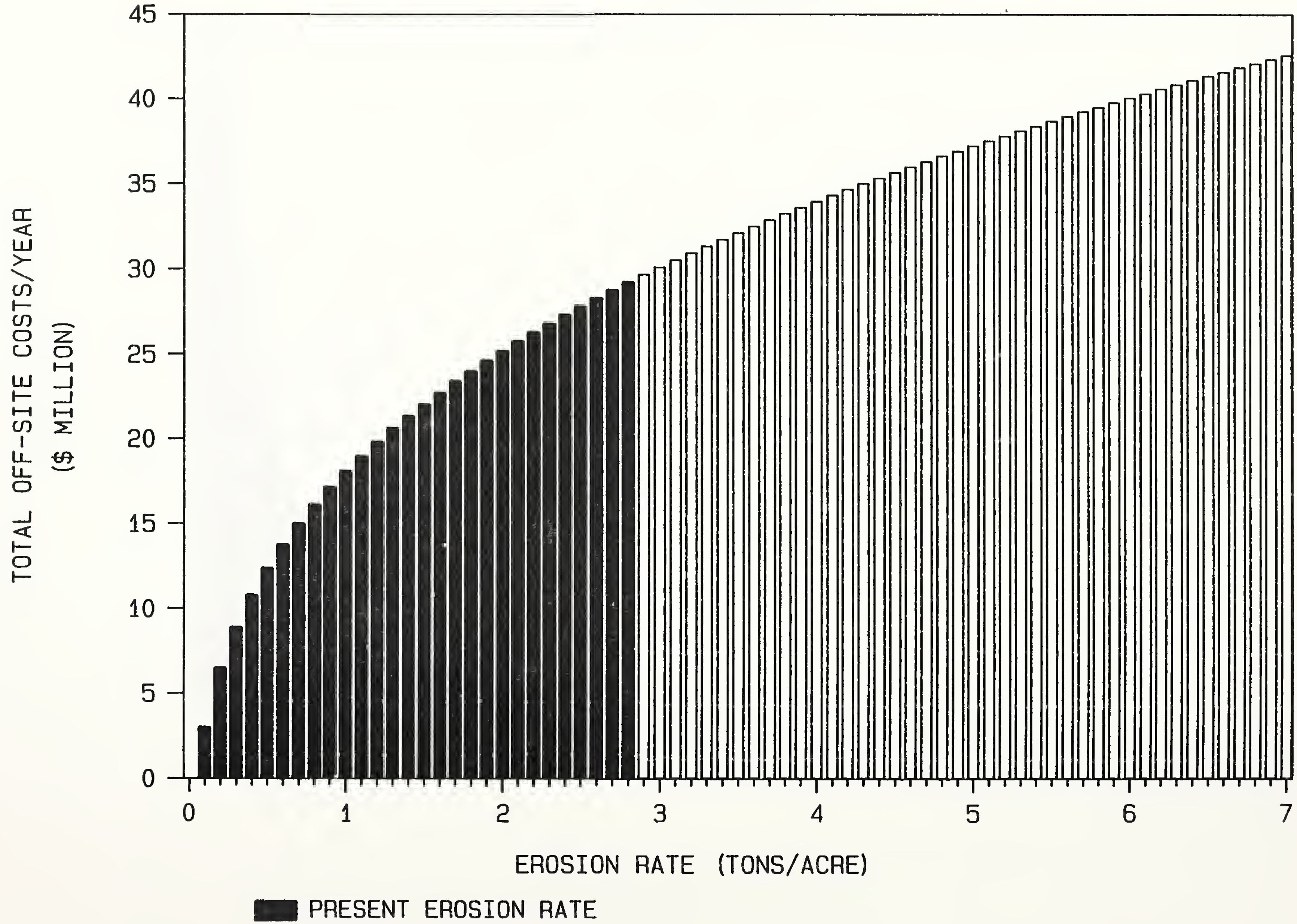


FIGURE 11. MARGINAL OFF–SITE COSTS OF WIND EROSION
MLRA 37

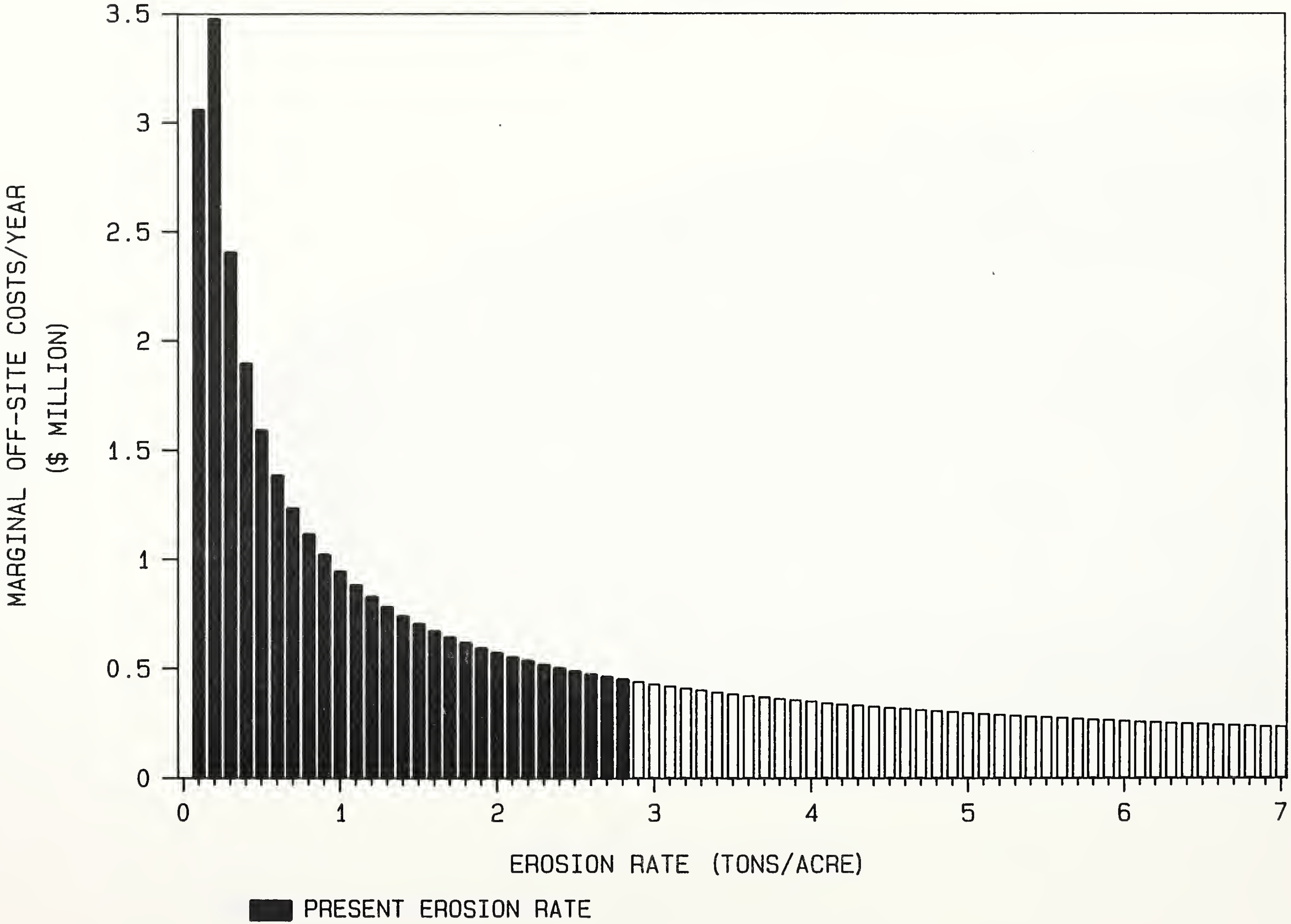


FIGURE 12. TOTAL OFF-SITE COSTS OF WIND EROSION
MLRA 36/39

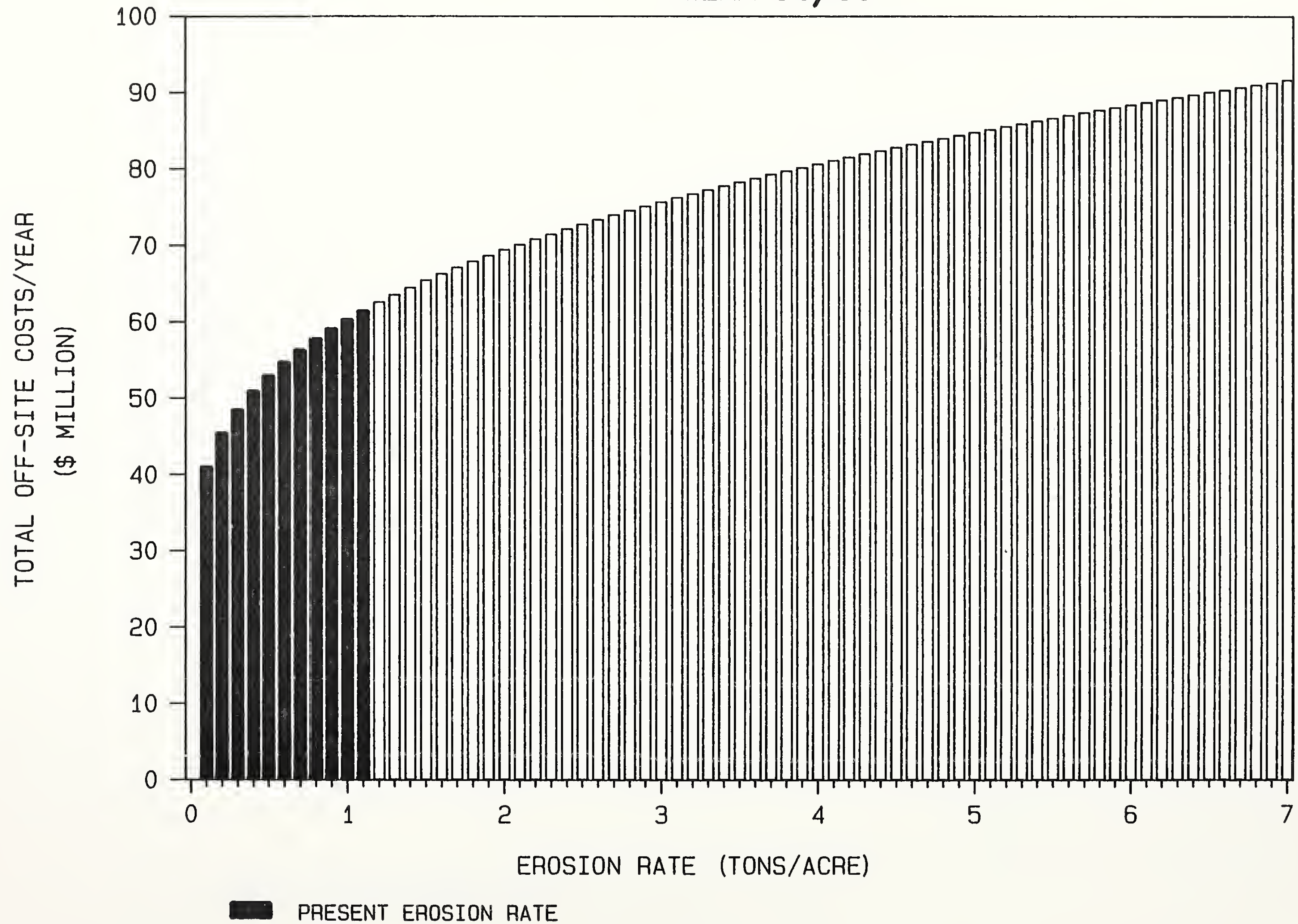


FIGURE 13. MARGINAL OFF-SITE COSTS OF WIND EROSION
MLRA 36/39

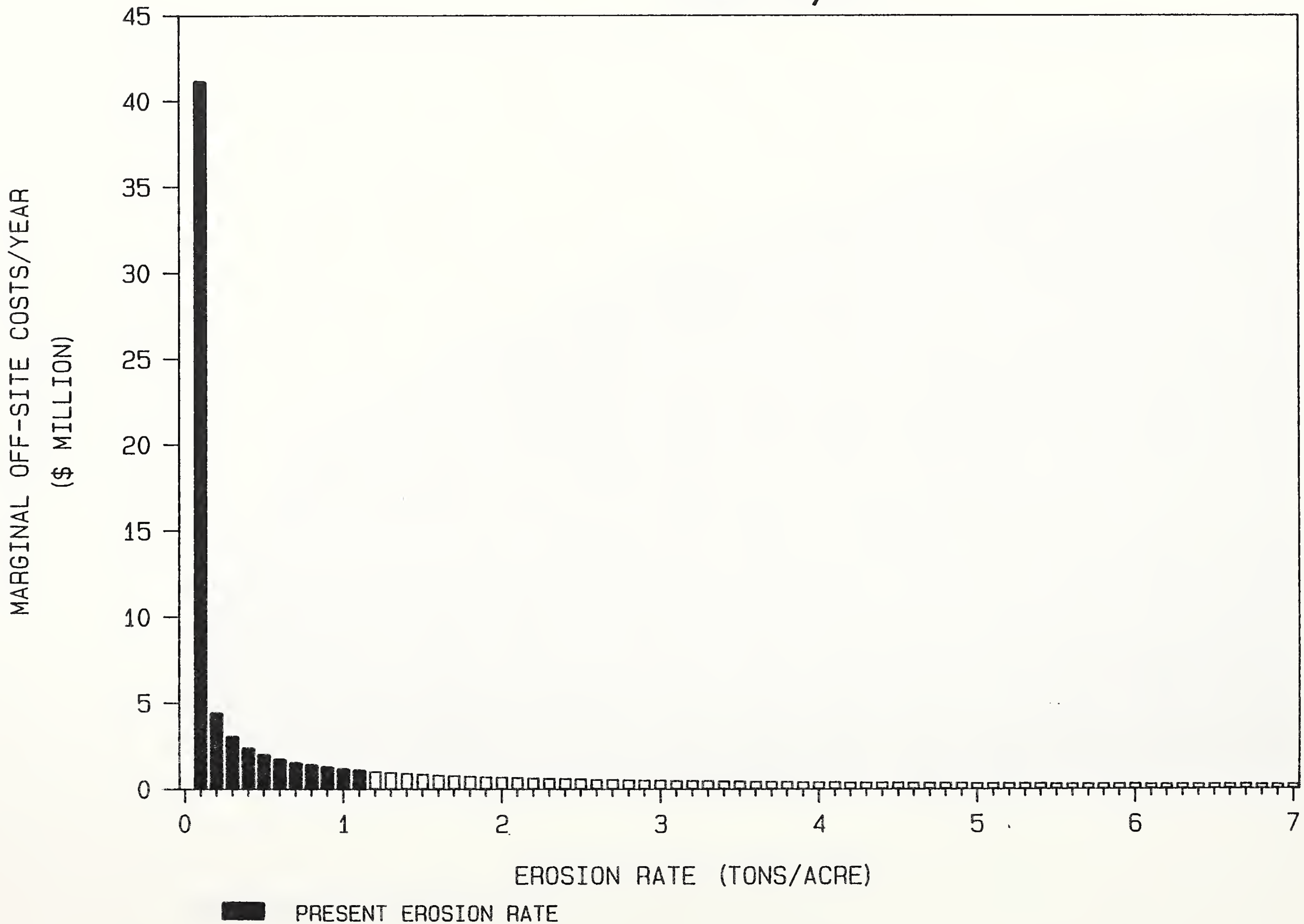


FIGURE 14. TOTAL OFF—SITE COSTS OF WIND EROSION
MLRA 48/51

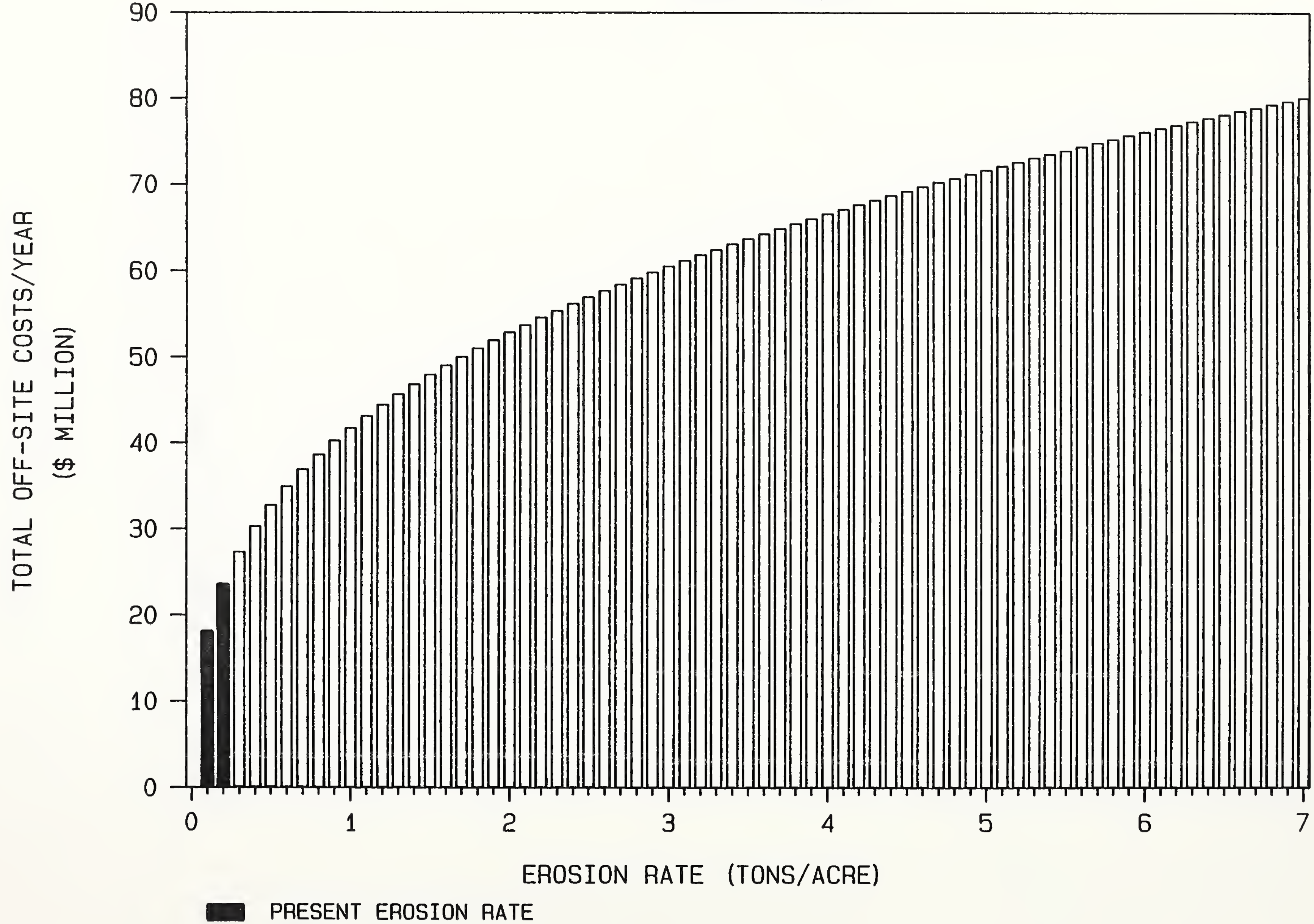


FIGURE 15. MARGINAL OFF-SITE COSTS OF WIND EROSION
MLRA 48/51

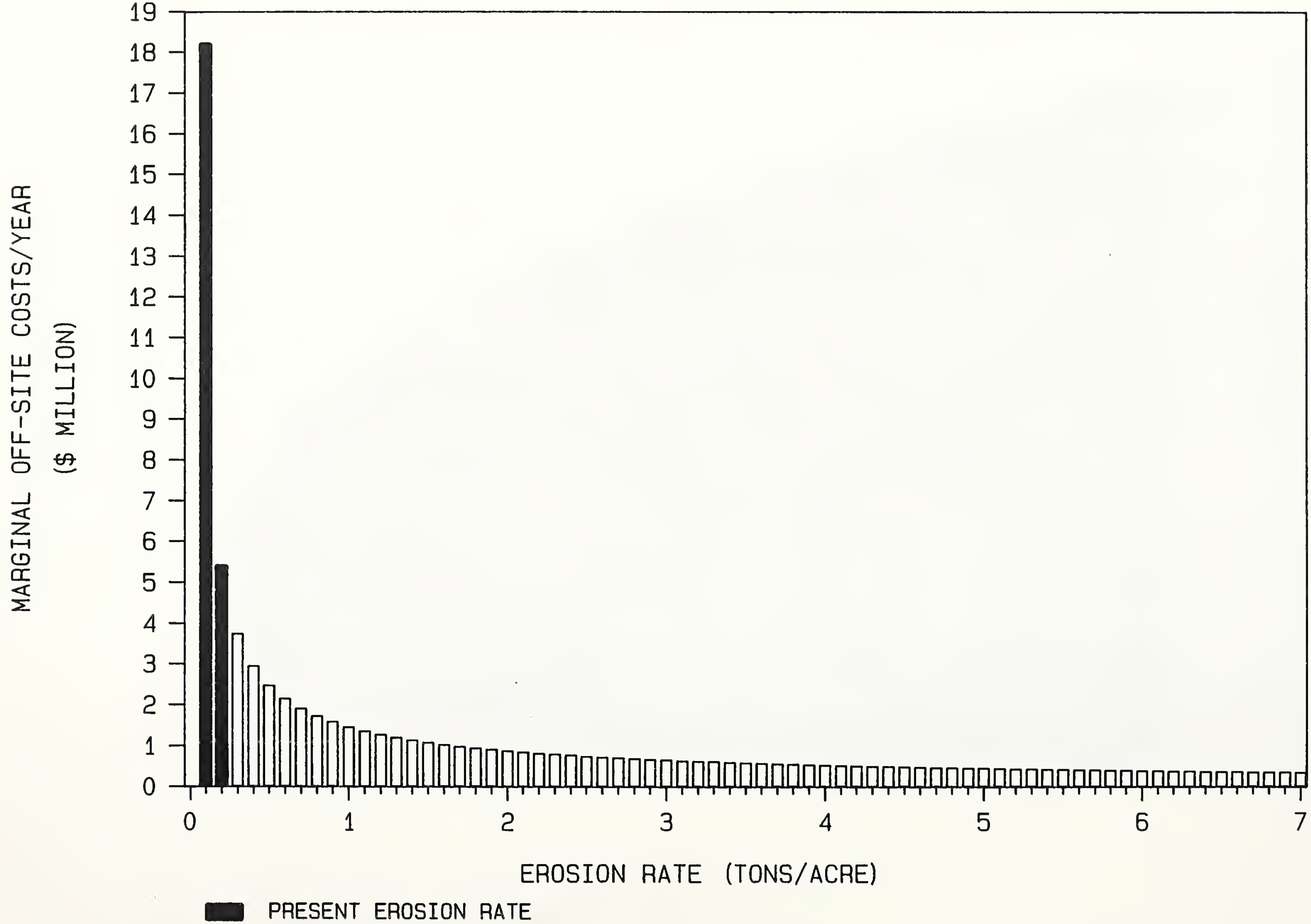


FIGURE 16. TOTAL OFF—SITE COSTS OF WIND EROSION
MLRA 42

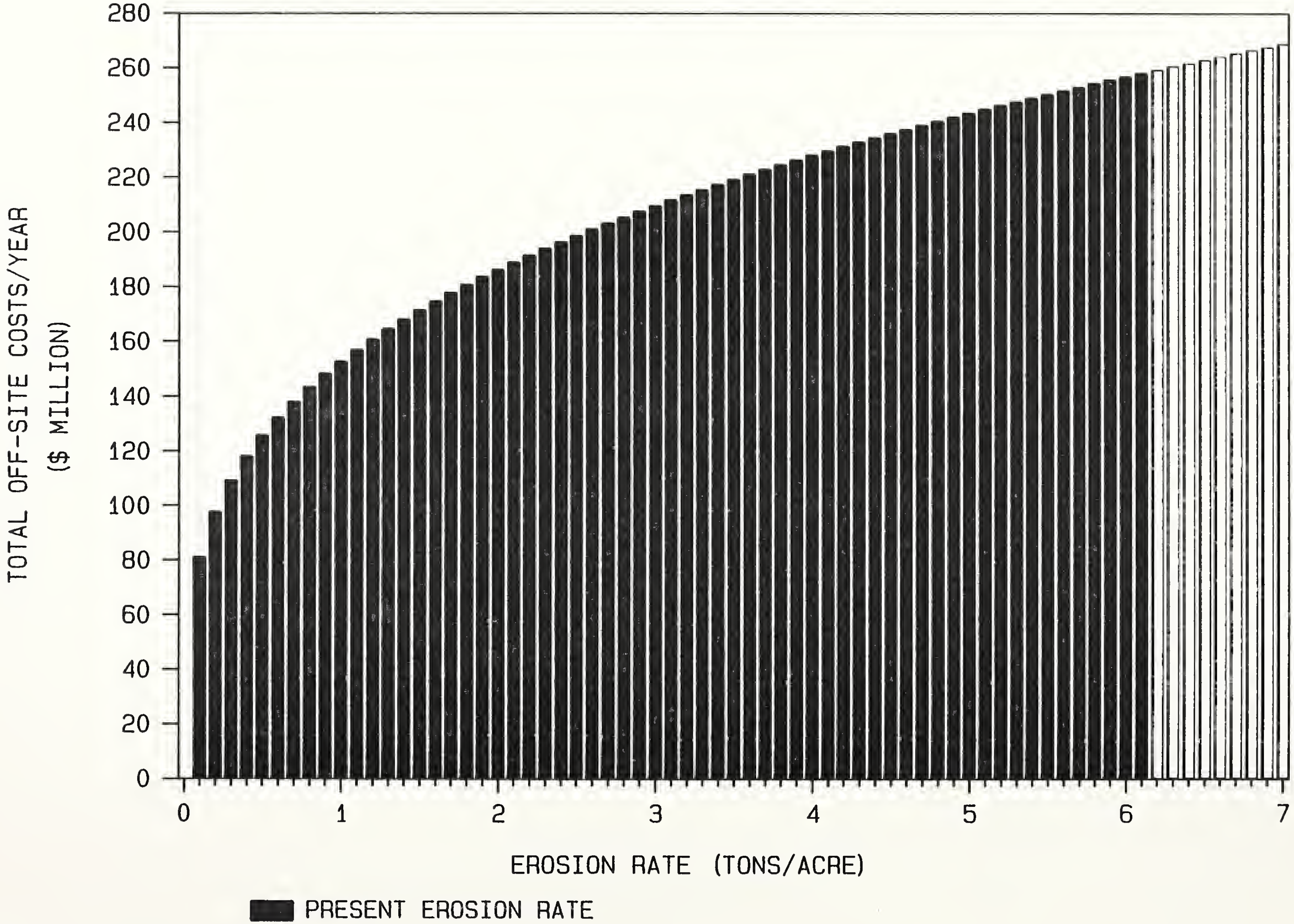


FIGURE 17. MARGINAL OFF-SITE COSTS OF WIND EROSION
MLRA 42

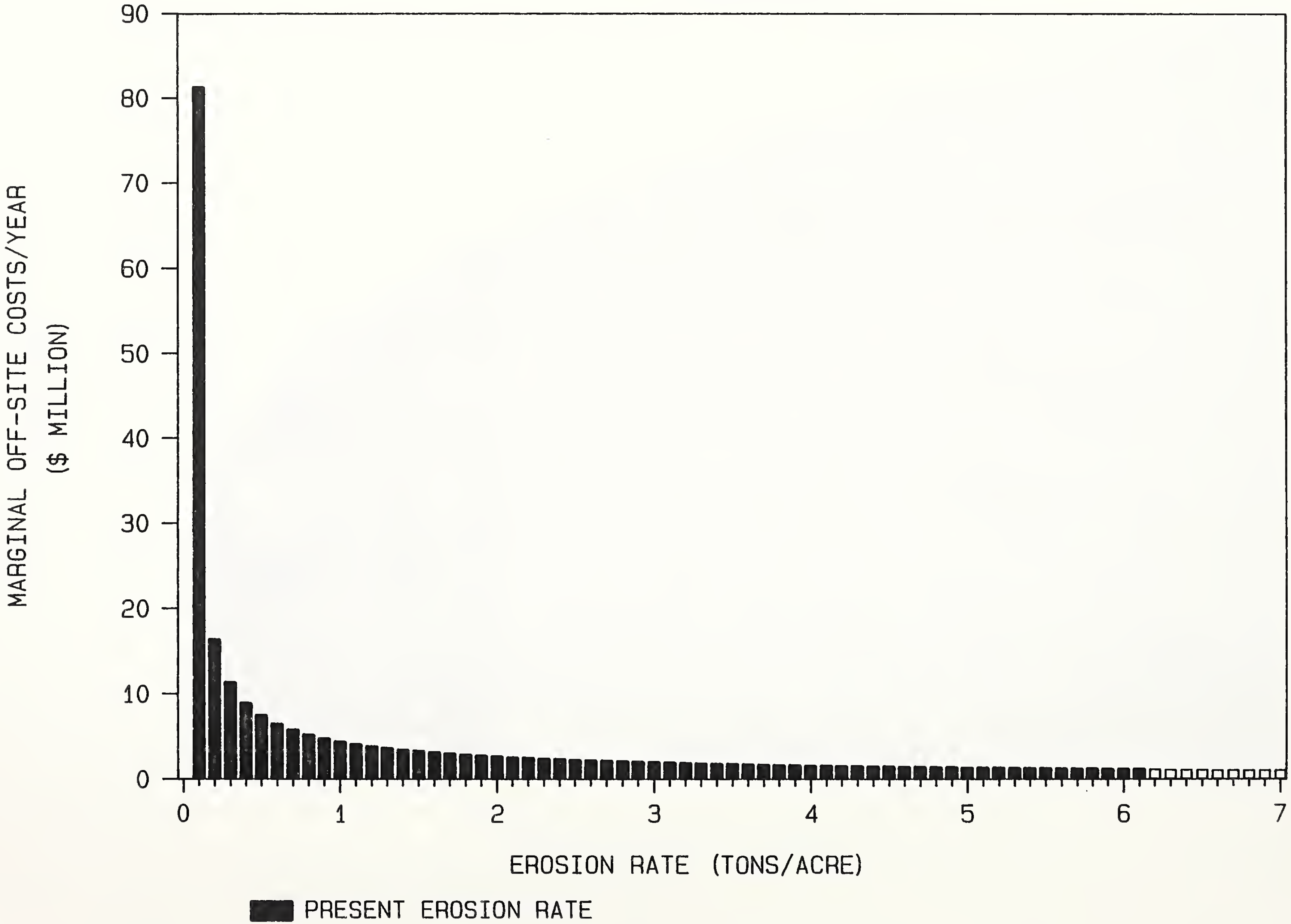


FIGURE 18. TOTAL OFF-SITE COSTS OF WIND EROSION
MLRA 70

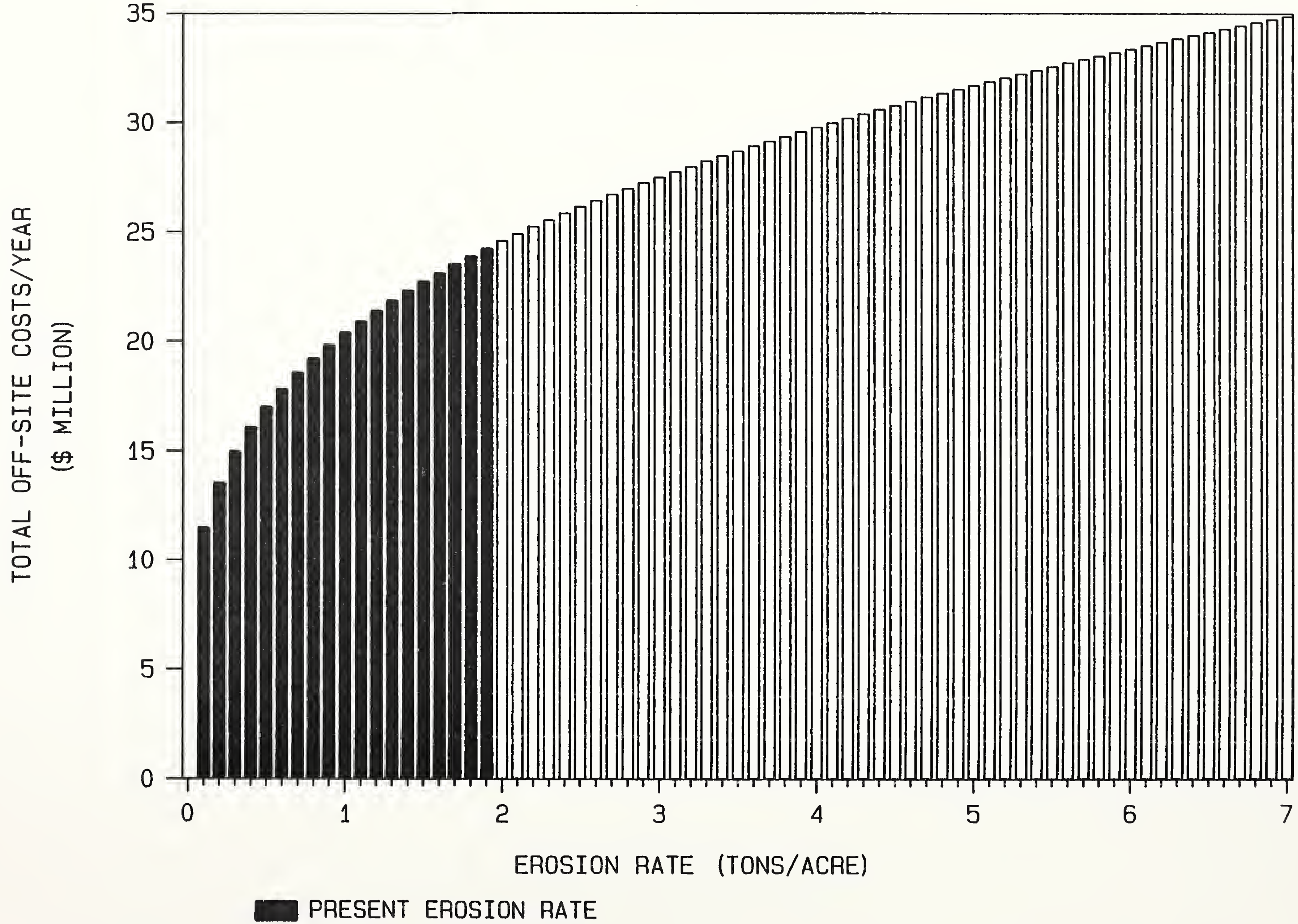


FIGURE 19. MARGINAL OFF-SITE COSTS OF WIND EROSION
MLRA 70

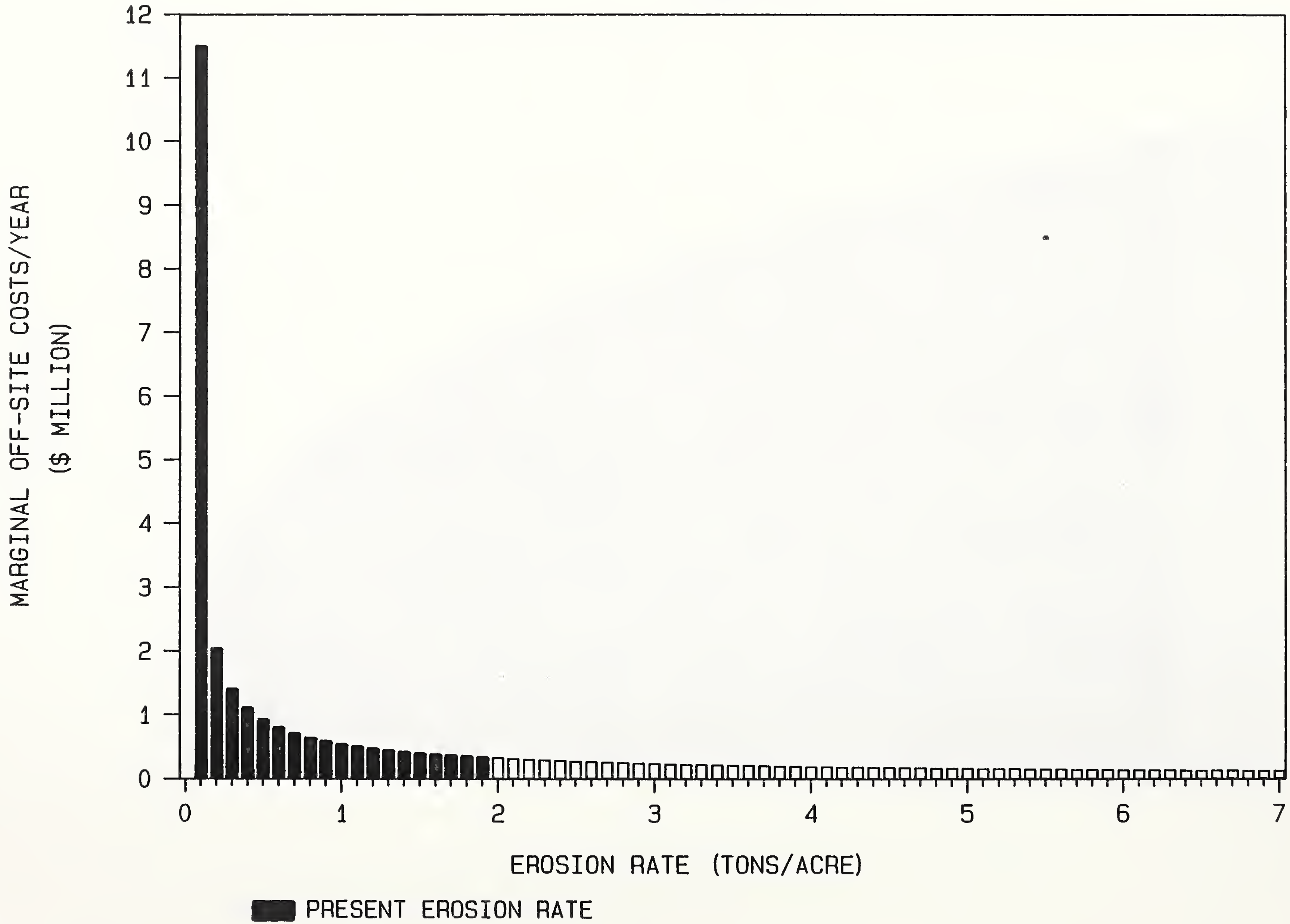


FIGURE 20. TOTAL OFF-SITE COSTS OF WIND EROSION
MLRA 77

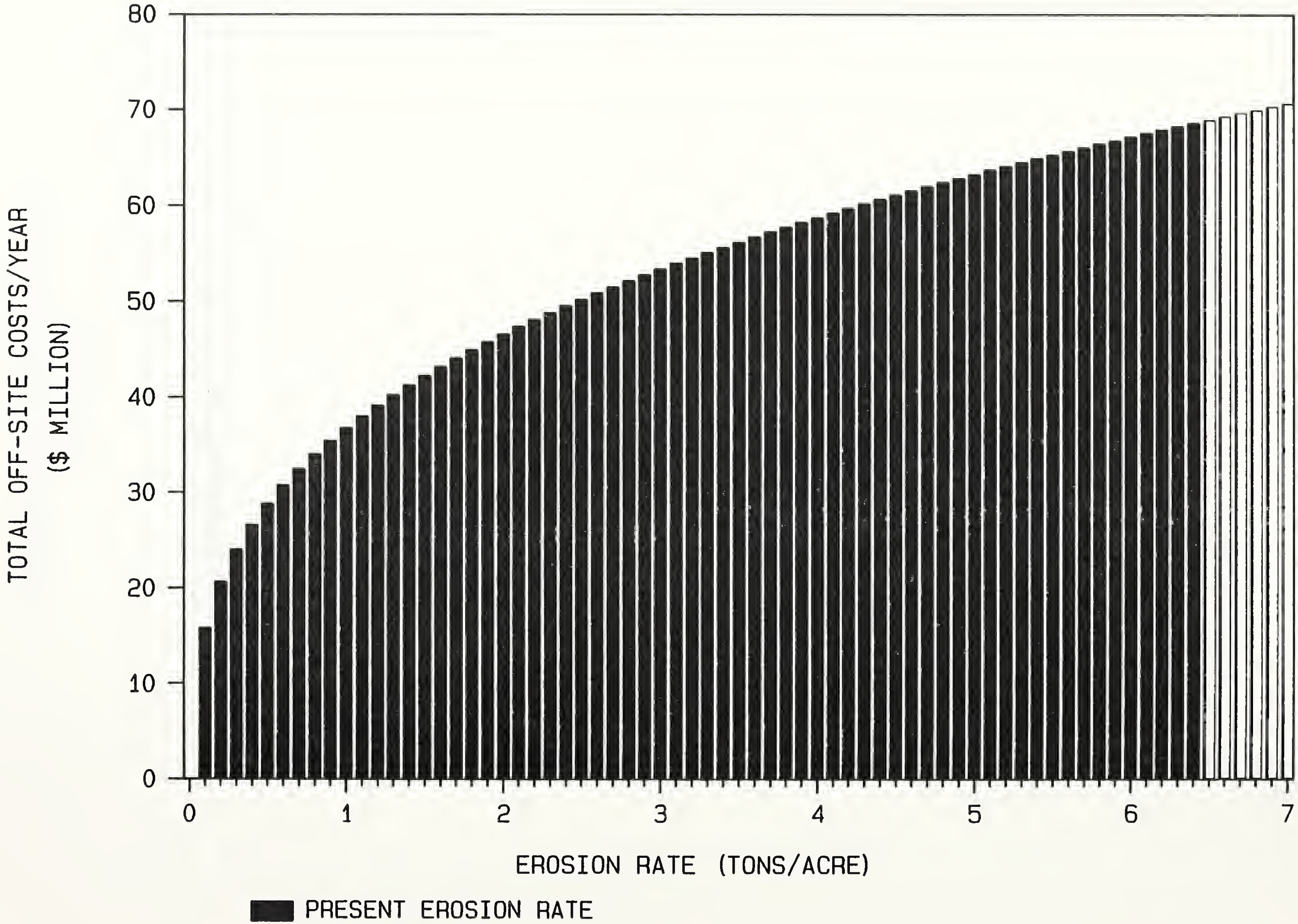
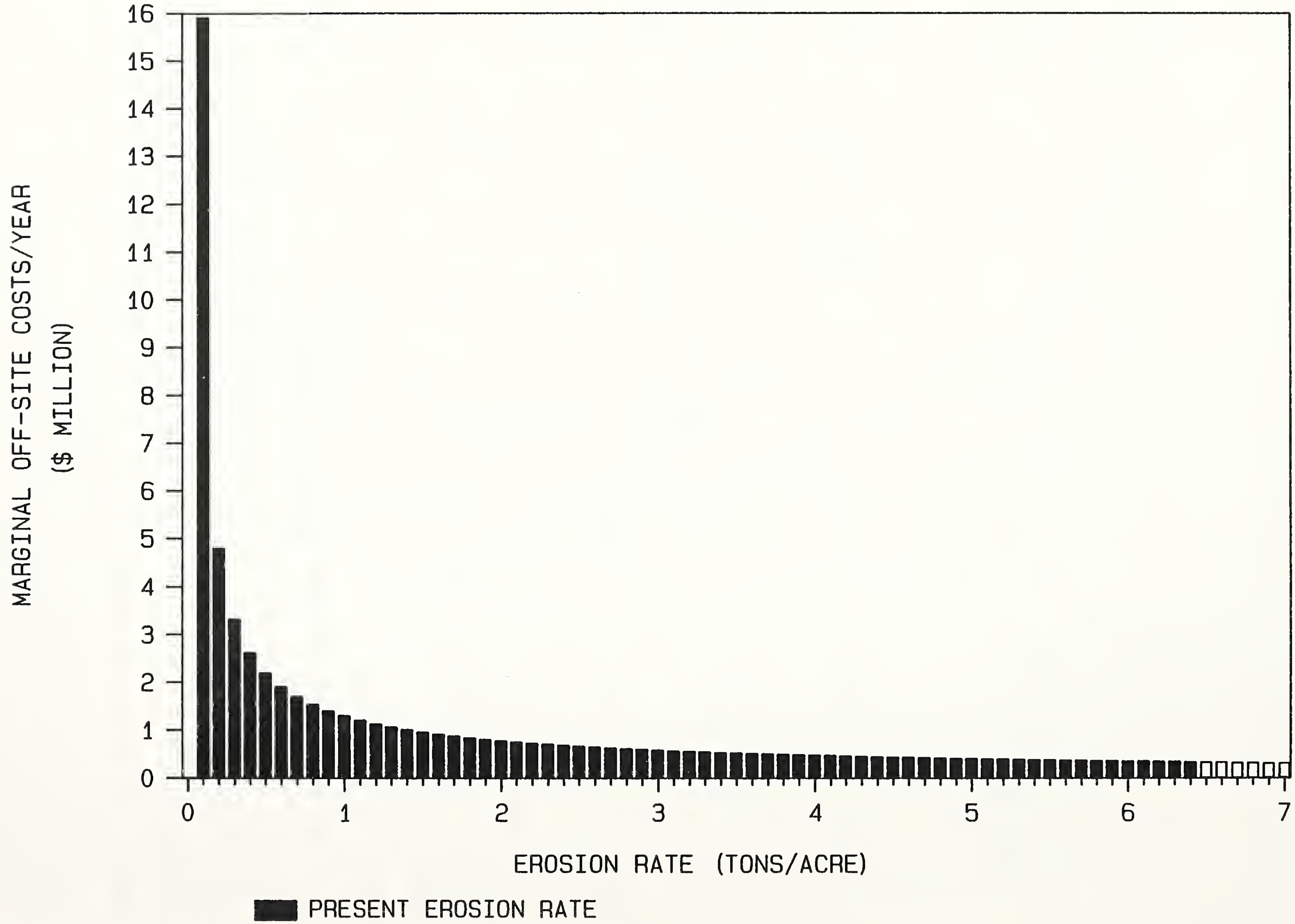


FIGURE 21. MARGINAL OFF–SITE COSTS OF WIND EROSION
MLRA 77



For example, the total off-site cost function shown for MLRA 42 in Figure 16 indicates that reducing erosion by 2 tons/acre from the present level of 6.1 tons/acre to 4.1 tons/acre will reduce off-site costs from $258.27 million to $229.85 million, or $28.42 million, but reducing erosion by 2 tons/acre from 2.1 tons/acre to 0.1 tons/acre will reduce off-site costs from $189.22 million to $81.39 million, or $107.83 million.

Alternatively, the marginal off-site cost function shown for MLRA 42 in Figure 17 indicates that reducing erosion from 6.1 tons/acre to 4.1 tons/acre will reduce off-site costs by the area of the bars between these two erosion rates (i.e., $28.42 million), but that reducing erosion from 2.1 tons/acre to 0.1 tons/acre will reduce off-site costs by the larger area of the bars between these two erosion rates (i.e., $107.83 million).

Moreover, Figure 17 indicates the off-site benefits in MLRA 42 of each tenth of a ton/acre reduction in the erosion rate. For example, reducing the erosion rate from 0.3 to 0.2 tons/acre decreases off-site costs by the height of the bar above 0.3 tons/acre in Figure 17 or $11.4 million. Reducing the erosion rate from 0.2 to 0.1 tons/acre reduces off-site costs by $16.5 million and so on. The first 0.1 ton/acre of wind erosion causes $81.4 million or nearly 32 percent of the total $258.27 million of off-site costs in MLRA 42, while the last 0.1 ton/acre of erosion (i.e., the 6.1th ton/acre) contributes only $1.2 million or less than 0.5 percent of the total off-site costs.

BENEFITS OF CONSERVATION PRACTICES

A statistical analysis of the NRI data [3] provides specific information on the effectiveness of various conservation practices. By applying the observed reductions in wind erosion due to differing conservation practices to lands without those practices, decreases in erosion rates and, consequently, off-site costs can be estimated. Table 4 and Figure 22 summarize the results in terms of total expected benefits.

Rangeland is the predominate source of off-site costs from wind erosion, accounting for nearly $402 million of the $430 million attributable to rangeland and cropland. The principle conservation measure utilized on rangeland in New Mexico is to develop proper grazing practices. This may entail the cost of fencing or, merely, of moving salt licks on a regular basis. The expected off-site benefits from implementing proper grazing on land without these practices are shown in Table 4 and range from $2.6 million in MLRA 48/51 to $106 million in MLRA 42. Benefits are computed by both land capability classification and by the rate of erosion on the land (i.e., >T and >2T). These estimates do not include benefits to rangeland which is untreatable due to steep slopes or other geological or climitalogical conditions that make treatment unfeasible.

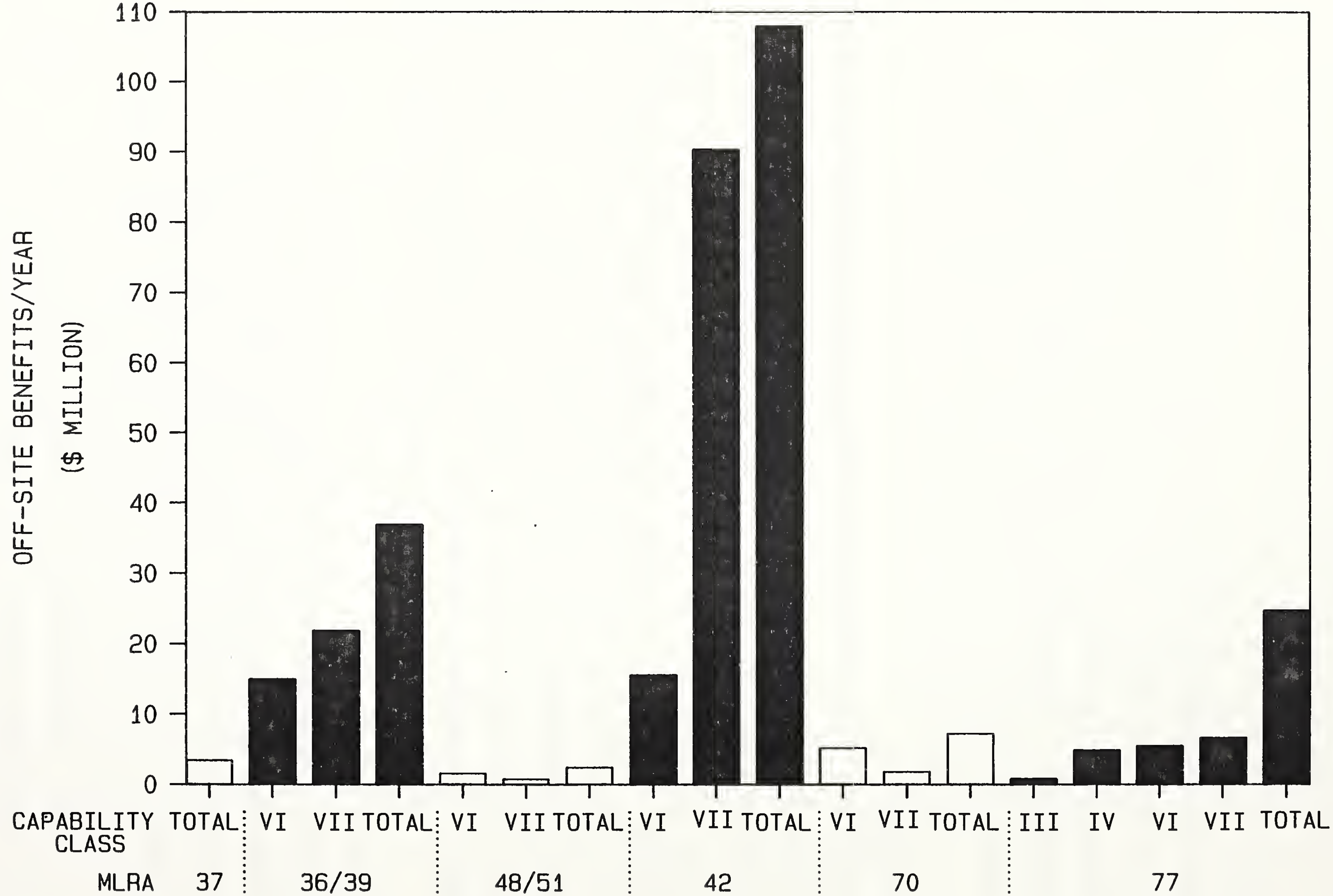
Data for assessing the effectiveness of conservation practices on cropland is insufficient for all MLRA's except 42 and 77. Approximately 95 percent of the cropland in MLRA 42 is irrigated, with the predominate conservation practice being some form of irrigation water management. These conservation

TABLE 4. POTENTIAL OFF-SITE BENEFITS OF SOIL CONSERVATION PRACTICES

MLRA	CAPABILITY CLASS	RANGELAND				CROPLAND		TOTAL	
		OFF-SITE COSTS	CONSERVATION BENEFITS ALL LAND	>T	>2T	OFF-SITE COSTS	CONSERVATION BENEFITS	OFF-SITE COSTS	BENEFIT
				($ MILLION)					
37	VII	3.60	---	---	---	---	---	3.60	0.00
	TOTAL	27.35	3.60	---	---	0.77	---	28.12	3.60
36/39	VI	21.50	15.10	4.40	3.30	---	---	21.50	15.10
	VII	25.00	22.00	14.70	13.80	---	---	25.00	22.00
	TOTAL	49.29	37.10	19.10	17.10	0.17	---	49.46	37.10
48/51	IV	0.10	---	---	---	---	---	0.10	0.00
	VI	3.50	1.70	---	---	---	---	3.50	1.70
	VII	1.70	0.90	---	---	---	---	1.70	0.90
	TOTAL	15.63	2.60	---	---	1.42	---	17.05	2.60
42	VI	23.80	15.70	2.20	1.90	---	---	23.80	15.70
	VII	133.60	90.50	47.50	27.90	---	---	133.60	90.50
	TOTAL	237.25	106.20	49.70	29.80	12.09	1.80	249.34	108.00
70	VI	6.80	5.40	1.90	0.40	---	---	6.80	5.40
	VII	3.60	2.00	0.30	0.30	---	---	3.60	2.00
	TOTAL	17.40	7.40	2.20	0.70	0.39	---	17.79	7.40
77	III	1.10	0.90	0.10	0.10	---	---	1.10	0.90
	IV	5.90	5.00	3.30	2.80	---	---	5.90	5.00
	VI	10.10	5.60	3.70	3.30	---	---	10.10	5.60
	VII	12.20	6.80	6.40	6.00	---	---	12.20	6.80
	TOTAL	54.93	18.30	13.50	12.20	13.27	6.60	68.20	24.90
TOTAL		401.85	175.20	84.50	59.80	28.11	8.40	429.96	183.60

Note: Blanks indicate that insufficient data exists for statistically significant results.

FIGURE 22. POTENTIAL OFF–SITE BENEFITS OF SOIL CONSERVATION BY LAND CAPABILITY CLASS AND MLRA



practices are primarily directed towards saving water and reducing water erosion, but some wind erosion benefits are also realized. Approximately 66 percent of the cropland in MLRA 77 is nonirrigated, with the predominate conservation practice being conservation tillage. Irrigation water management is also practiced and reduces, to some extent, wind erosion. The expected off-site benefits of reductions in wind erosion resulting from conservation practices are also summarized in Table 4.

The costs of conservation practices on such a broad scale may be impossible to determine. Proper grazing practices may cost practically nothing or as much as $20/acre. Irrigation water management costs are also highly variable. Conservation tillage actually costs less than conventional tillage on an annual basis and the initial conversion costs may be covered in as little time as one year. Rather than estimate the costs of conservation, the approach taken here is to calculate the benefits on a per acre basis. Moreover, the focus is on rangeland soil conservation, since it has the greatest potential benefits.

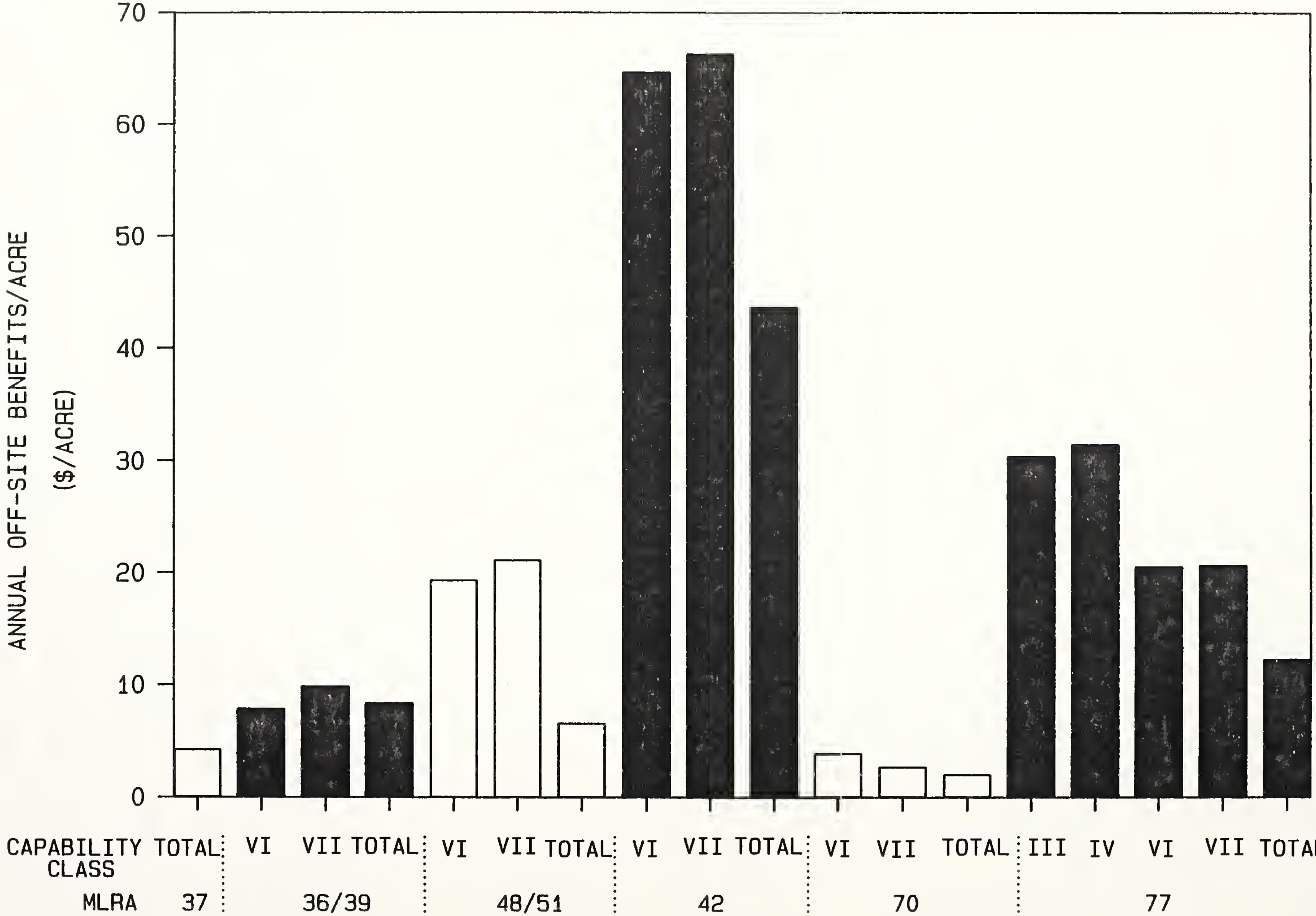
Table 5 and Figure 23 summarize the expected off-site benefits per acre of rangeland receiving proper grazing management. The expected benefits range from $4/acre to $64.58/acre for class VI land and from $2.80/acre to $66.31/acre for class VII land. Within each MLRA, the potential returns per acre are greatest on class VII land, with the exception of MLRA 70.

TABLE 5. POTENTIAL OFF-SITE BENEFITS/ACRE OF RANGELAND SOIL CONSERVATION PRACTICES

MLRA	LAND CLASSIFICATION						
	CAPABILITY CLASS				T-FACTOR		ALL
	III	IV	VI	VII	>T	>2T	
				($/ACRE)			
37	---	---	---	---	---	---	4.34
36/39	---	---	7.93	9.93	17.29	20.24	8.49
48/51	---	---	19.47	21.22	---	---	6.67
42	---	---	64.58	66.31	28.08	20.41	43.82
70	---	---	4.00	2.80	1.09	0.57	2.14
77	30.46	31.55	20.64	20.75	16.17	21.98	12.40
TOTAL	30.46	31.55	23.32	24.20	14.73	14.66	13.54

Note: Blanks indicate that insufficient data exist for statistically significant results.

FIGURE 23. POTENTIAL OFF–SITE BENEFITS/ACRE OF RANGELAND CONSERVATION BY LAND CAPABILITY CLASS AND MLRA



Calculations using the T-factor show a range of off-site benefits from $1.09/acre to $28.08/acre for land with erosion rates greater than T and from $0.57/acre to $21.98/acre for land with erosion rates greater than 2T.

MLRA 42 stands out as having the greatest potential benefits per acre regardless of how the benefits are computed. Moreover, if per acre costs of conservation are $20 or less, then rangeland conservation would pay in terms of off-site benefits alone in MLRA's 48/51, 42, and 77.

CONCLUSIONS

The following conclusions follow from the analysis:

1. Off-site costs of wind erosion are a diminishing function of the erosion rate and the value of property at risk.

2. Over 55 percent of the off-site costs of wind erosion are incurred in MLRA 42 and, within MLRA 42, Bernalillo County accounts for nearly 50 percent of the damages. In fact, Bernalillo County accounts for nearly 28 percent of the state's off-site costs of wind erosion.

3. Nine counties have annual off-site costs in excess of $20 million: Bernalillo, Valencia, McKinley, Sandoval, San Juan, Dona Ana, Eddy, Lea and Curry counties. At the other end of the spectrum, twelve counties have off-site costs of less than $5 million: Union, Sierra, Hidalgo, Taos, Guadalupe, Catron, DeBaca, Harding, Mora, Colfax, Los Alamos and Ciboloa counties.

4. Population growth alone will likely increase annual off-site costs of wind erosion in New Mexico from the present level of nearly $466 million to over $578 million by the year 2005. Off-site costs in Bernalillo County are projected to increase from nearly $129 million to over $156 million by the year 2005.

5. The returns from reducing wind erosion increase at an increasing rate as the rate of erosion is reduced. For example, in MLRA 42 the last 0.1th ton/acre of erosion accounts for only $1.2 million of off-site costs, but the first 0.1th ton/acre accounts for $81.4 million.

6. The greatest returns from present soil conservation practices are on rangeland. The expected benefits range from $4/acre to nearly $65/acre on class VI land and from nearly $3/acre to over $66/acre on class VII land. Estimates of returns from class III and IV land are not possible due to insufficient data.

7. MLRA 42 stands out as having the greatest potential benefits per acre. Moreover, if conservation costs are $20/acre or less, then rangeland soil conservation has benefits greater than costs in MLRA's 48/51, 42, and 77.

8. Since the damage function is not able to discriminate between sources of soil erosion by location, it may under estimate returns from soil conservation nearer population centers and over estimate returns from soil conservation further from population centers. That is, off-site benefits of soil conservation can be expected to decline with distance from cities.

9. Finally, while present soil conservation practices applied to untreated land have the potential to significantly reduce off-site costs of wind erosion, opportunities exist for new approaches to reduce wind erosion. For example, application of present soil conservation practices to untreated land in MLRA 42 could potentially reduce off-site costs by $108 million, leaving over $141 million of off-site costs that might be reduced by new approaches.

REFERENCES

1. Davis, Robert and Condra, Gary D. 1985. The On-Site Costs Of Wind Erosion In New Mexico. Final Report to the Soil Conservation Service, U.S.D.A., Albuquerque, NM. Department of Agricultural Economics, Texas Tech University, Lubbock, Texas.

2. Huszar, Paul C. 1985. Off-Site Economic Costs Of Wind Erosion In New Mexico. Special Study Report for the Soil Conservation Service, U.S.D.A., Albuquerque, NM. ANRE Research Report AR:85-3, Department of Agricultural & Natural Resource Economics, Colorado State University, Ft. Collins, Colorado.

3. Soil Conservation Service, U.S.D.A. 1984. 1982 National Resources Inventory Data for New Mexico. Unpublished computer tape.

4. Stults, Harold; Dawson, Robert; Raitt, Daryll; and Williams, Jerry. 1987. Targeting Erosion Control: Economic Effects. Economic Research Service, U.S.D.A., Conservation Research Report No. 36.